



Final Environmental Report for Batchfire Callide Mine

Response to EEN - Final Report

PREPARED FOR

Batchfire Callide Management Pty Ltd

DATE

26/06/2024

REFERENCE

0637703-03



DOCUMENT DETAILS

DOCUMENT TITLE	Final Environmental Report for Batchfire Callide Mine
DOCUMENT SUBTITLE	Response to EEN - Final Report
PROJECT NUMBER	0637703-03
Date	26/06/2024
Version	03
Author	Ross Lawrence, Patrick Mason
Client name	Batchfire Callide Management Pty Ltd

DOCUMENT HISTORY

				ERM APPROVAL TO ISSUE		
VERSION	REVISION	AUTHOR	REVIEWED BY	NAME	DATE	COMMENTS
Draft	01	Ross Lawrence Patrick Mason	Ken Keifer	Chris Gimber	21/06/2024	Draft
Draft	02	Ross Lawrence Patrick Mason	Ken Keifer	Chris Gimber	25/06/2024	Draft R2
Final	03	Ross Lawrence	Patrick Mason Ken Keifer	Chris Gimber	26/06/2024	Final

SIGNATURE PAGE

Final Environmental Report for Batchfire Callide Mine

Response to EEN - Final Report
0637703-03



Ross Lawrence

Lead Suitability Qualified Person (SQP) and
Senior Environmental Consultant



Patrick Mason

Senior Environmental Consultant/Hydrogeologist



Ken Kiefer

Technical Director



Chris Gimber

Partner

Environmental Resources Management
Australia Pty Ltd
Level 14, 207 Kent Street
Sydney NSW 2000
T +61 2 8584 8888

© Copyright 2024 by The ERM International Group Limited and/or its affiliates ('ERM'). All Rights Reserved.
No part of this work may be reproduced or transmitted in any form or by any means, without prior written permission of ERM.

CONTENTS

1.	INTRODUCTION	1
1.1	EEN ASSESSMENT AND REPORTING REQUIREMENTS	1
1.2	SITE DESCRIPTIONS	4
1.2.1	Southern Operations	5
1.2.2	Boundary Hill	1
1.3	REGULATORY CONTEXT	2
1.4	OBJECTIVES	3
1.5	STATEMENT OF WORKS	3
2.	ENVIRONMENTAL SETTING	5
2.1	HISTORICAL SETTING	5
2.2	CLIMATE AND RAINFALL	5
2.3	SITE TOPOGRAPHY	6
2.3.1	Southern Operations	6
2.3.2	Boundary Hill	7
2.4	SITE HYDROLOGY	7
2.4.1	Southern Operations	7
2.4.2	Boundary Hill	8
3.	SITE ASSESSMENT COMPLETED TO DATE	10
3.1	SOUTHERN OPERATIONS	10
3.2	BOUNDARY HILL	12
4.	FIELD INVESTIGATION RESULTS AND OBSERVATIONS	15
4.1	SOUTHERN OPERATIONS	15
4.2	BOUNDARY HILL	20
5.	QUALITY ASSESSMENT	24
5.1	SOUTHERN OPERATIONS QA/QC ASSESSMENT	24
5.2	BOUNDARY HILL AQ/QC ASSESSEMENT	25
6.	CONCEPTUAL SITE MODEL	27
6.1	SOUTHERN OPERATIONS	27
6.2	BOUNDARY HILL	31
6.3	MIGRATION MECHANISMS	34
6.4	KEY PFAS MIGRATION PATHWAYS	34
6.4.1	Southern Operations	34
6.4.2	Boundary Hill	35
7.	ASSESSMENT OF PFAS DISTRIBUTION	36
7.1	SOUTHERN OPERATIONS	36
7.2	BOUNDARY HILL	36

8.	IDENTIFIED DATA GAPS IN THE DSI REPORTS	37
8.1	SOUTHERN OPERATIONS	37
8.2	BOUNDARY HILL	38
9.	RISK MANAGEMENT AND MITIGATION MEASURES	40
9.1	SOUTHERN OPERATIONS	40
9.2	BOUNDARY HILL	41
10.	CONCLUSIONS	42
11.	REFERENCES	43
12.	STATEMENT OF LIMITATIONS	45

APPENDIX A FIGURES

APPENDIX B WORK PLANS

APPENDIX C DATA TABLES

APPENDIX D ENVIRONMENTAL EVALUATION NOTICE

LIST OF FIGURES

FIGURE A. SITE PLAN OF THE SOUTHERN OPERATIONS DUNN CREEK MIA, SAMPLING POINTS AND SURFACE WATER DRAINAGE PATHS	6
FIGURE B. SITE PLAN OF THE BOUNDARY HILL MIA, SAMPLING POINTS AND SURFACE WATER FLOW PATHS	2
FIGURE C. MONTHLY RAINFALL AT THANGOOL AIRPORT, JANUARY 2021 TO AUGUST 2023 (BOM STATION 039089) THANGOOL AIRPORT	6
FIGURE D. CONCEPTUAL SITE MODEL OF THE SOUTHERN OPERATIONS AREA SURFACE AND GROUNDWATER FLOWS	30
FIGURE E. CONCEPTUAL SITE MODEL OF THE BOUNDARY HILL SITE SURFACE AND GROUNDWATER FLOWS.	33

ACRONYMS AND ABBREVIATIONS

Name	Description
AFFF	Aqueous Film Forming Foam
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure
ASLP	Australian Standard Leaching Procedure
Batchfire	Batchfire Callide Management Pty Ltd
BW	Beneficial Water
CCM	Callide Coal Measures
CLA	Contaminated Land Auditor
CLID	Contaminated Land Investigation Document

Name	Description
CSM	Conceptual Site Model
DESI	Queensland Department of Environment, Science and Innovation
DSI	Detailed Site Investigation
EEN	Environmental Evaluation Notice
ERM	ERM Australia Pacific Pty Ltd
EV	Environmental Value
FTA	Fire Training Area
FtS	Fluorotelomer sulfonic acids (Fluorotelomers)
LDPE	Low density polyethylene
LOR	Limit of Reporting
MIA	Mining Infrastructure Area
MSDS	Material Safety Data Sheet
OCWB	Oakey Creek Water Borefield
PFAS	Per- and Poly-Fluoroalkyl Substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFHxA	Perfluorohexanoic acid
PFAS NEMP	PFAS National Environmental Management Plan
PSI	Preliminary Site Investigation
QA/QC	Quality assurance / quality control
SPR	Source-Pathway-Receptor
SAQP	Sampling and Quality Plan
SQP	Suitably Qualified Person
TOC	Total Organic Carbon
TOF	Total Organic Fluorine
TOPA	Total Oxidisable Precursor Assay
WQO	Water Quality Objective

1. INTRODUCTION

ERM Australia Pacific Pty Ltd (ERM) was commissioned by Batchfire Callide Management Pty Ltd (Batchfire) to undertake a Detailed Site Investigation (DSI) of the main site area (known as the Callide Mine Southern Operations) and the secondary site area (known as the Boundary Hill mine), focused on Per – and Poly Fluoroalkyl Substances (PFAS) in soil, sediment, surface water and groundwater. This DSI follows on from a request from the Queensland Department of Environment, Science and Innovation (DESI) for information on the usage of Aqueous Film - Forming Foam (AFFF) at the site due to PFAS detection in groundwater samples obtained from bores within the Callide Alluvial Aquifer, down gradient from the Callide B Power Station. The Callide B power station is located down gradient from the Southern Operations Mining Infrastructure Area (MIA) of the Batchfire Callide Mine.

Further to this request, DESI has issued an Environmental Evaluation Notice (EEN) on 16 December 2021 (DESI reference: STAT-E-100078550). This EEN has been amended several times with the latest amendment extending the reporting timelines issued 16 October 2023, the DESI reference: STAT-E_100078550 remains the same. As part of the requirement of the EEN, Batchfire engaged an approved Contaminated Land Auditor (CLA) to review the Work Plan (incorporating a Sampling Analysis and Quality Plan (SAQP)) and following review of the work plan, to review the PSI and DSI reports (one PSI and DSI report for each site), with the DSI report being submitted as a Contaminated Land Investigation Document (CLID).

The DSI report is drafted as a two-part document, with Part A referring to the Southern Operations mine and Part B referring to the Boundary Hill mine for greater clarity. The two mine sites are approximately eighteen kilometres apart and have different layouts, geology, hydrogeology, hydrology and water storages. However, it should be noted that a CLID cannot focus only on a specified contaminant or be certified for land that is not listed on the EMR. Both conditions are not met by the scope of this report; however, this is the limitation accepted by DESI under the EEN notice.

1.1 EEN ASSESSMENT AND REPORTING REQUIREMENTS

The EEN lists ten requirements for reporting to DESI:

1. Engagement of a Suitably Qualified Person (SQP) by **5:00pm on 31st December 2021**.
This requirement has been met.
2. Engagement of a Contaminated Land Auditor (CLA) by **5:00pm on 25 February 2022**.
This requirement has been met.
3. In the event that monitoring of the affected environment identifies a risk of public exposure to PFAS at concentrations greater than the relevant human health guideline value, Batchfire must notify the department of the results and findings within 24 hours of becoming aware of the risk. *This requirement was triggered with Batchfire notifying the department on the 5 October 2023.*
4. Submission of a Preliminary Site Investigation (PSI) report by **5:00pm on 29 April 2022**.
The PSI must include:

- a. Identification of current and historical activities undertaken at the premises which has involved the use, storage (including volume), handling, foam types and potential release of PFAS containing material;
- b. Identification of all PFAS contaminant source zones and potential pathways into the environment;
- c. Identification of the relevant environmental values, including an evaluation of the uses of land and waters, and any potential impact and risks to the users as a result of potential PFAS contamination;
- d. Identification of the Data Quality Objectives (DQOs) as defined in Schedule B2 of the ASC NEPM;
- e. A summary of the monitoring results completed prior to 29 April 2022; and
- f. Preliminary Conceptual Site Model (CSM).

This requirement has been met.

5. Batchfire must develop and submit a work plan by **5:00pm on 10 June 2022** outlining the overall investigation strategy for the Detailed Site Investigation (DSI), inclusive of Sampling, analysis and quality plan (SAQP).
 - a. The SAQP may include a staged approach, such as Sampling Phase 1 to characterise the source, cause and extent of PFAS contamination at the premises for the purpose of preparing a site investigation report as defined in section 387 of the Act. Followed by Sampling Phase 2 if required for supplementary sampling based on remaining information gaps.
 - b. This SAQP must be prepared by a SQP and consented to by a contaminated land auditor.

Comments provided to Batchfire by the department by **5:00pm on 1 July 2022** (if any) must be incorporated in the sampling, analysis and quality plan prior to implementing the plan. *This requirement has been met.*

6. Batchfire must commence sampling and analysis in accordance with the SAQP by **5:00 on 26 June 2022** to determine the nature and extent of PFAS contamination arising from any direct or indirect release of PFAS in relation to the premises. *This requirement has been met.*
7. Batchfire must submit a Contaminated Land Investigation Document (CLID) by **5:00pm on 31 May 2024**. The CLID must be a detailed DSI report detailing the findings of the sampling, analysis and quality plan to determine the nature and extent of impact arising from the direct or indirect release of any PFAS contaminants from the release of AFFF. *This requirement has been met.*
8. The investigations required by this notice must meet the requirements for a CLID for the land in accordance with section 389 and 390 of the Act. A CLID must be prepared by a SQP as required by and in accordance with Chapter 12, Part 3 of the Act and be accompanied by an auditor certification that the CLID complies with section 389(1) and (2) of the Act. This requirement has been met, although with the caveat that a CLID must address all contaminants potentially within the site while this DSI specifically addresses only PFAS.

Additionally, a CLID may not be carried out on land that is not listed on the Queensland Environmental Management Register (EMR). This DSI report does not meet these conditions under S389 and S390 of the Act. Auditor review comments will be provided, however; an Auditor certification will not be provided. These limitations have been formally notified to DESI. *The requirement for a CLID that conforms to the EP Act cannot be met.*

9. Batchfire must ensure that the following requirements, to the extent that they are applicable and specified requirements are not otherwise referred to, are met when conducting the investigation and preparing the report:
 - a. The investigation is conducted in accordance with the following:
 - i. The Act – see <https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-1994-062>;
 - ii. The Policy – see <https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2019-0156>;
 - iii. Queensland Water Quality Guidelines (2009) – see <https://environment.des.qld.gov.au/management/water/quality-guidelines>;
 - iv. Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009 Version 2 September 2010 see - <http://www.ehp.qld.gov.au/water/pdf/monitoring-man-2009-v2.pdf>;
 - v. National Environmental Protection (Assessment of Site Contamination) Measure 1999 – see <https://www.legislation.gov.au/Details/F2013C00288>;
 - vi. Guidelines for Contaminated Land Professionals – see <https://www.qld.gov.au/environment/pollution/management/contaminated-land>;
 - vii. Assessment of impact of human health considering the Tolerable Daily Intakes for PFOS, PFOA, and PFHxS recommended by Food Standards Australia New Zealand (FSANZ);
 - viii. Where PFAS are encountered in water bodies at the premise which are accessible to fauna such as birds and mammals, qualitative consideration of water to animal bioaccumulation factors reported in research publications concerning those contaminants in evaluating potential environmental harm to such animals; and
 - ix. Assessment of contamination considering guidance provided in the PFAS NEMP – see <https://www.qld.gov.au/environment/pollution/management/disasters/investigation-n-pfas/management-plan>.
 - b. An assessment of edible portions (biota) must be used in estimating risks of exceeding the tolerable daily intakes, being consistent with the Queensland Health Guideline for sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination (see https://www.qld.gov.au/__data/assets/pdf_file/0032/68684/pfas-fish-sampling-protocol.pdf) and adopting portion sizes recommended by Food Standards Australia New Zealand (FSANZ) in addition to assessment of whole species (biota) to evaluate bioaccumulation risk; and

- c. Wherever practical, all samples must be analysed by a NATA accredited laboratory (it is noted that in biota sampling this may not be applicable); and
- d. The analytical data on all media (soil, sediment, water, groundwater and biota) must include results for sampling to determine total organic fluorine, total oxidisable precursor (TOP) assay, and the suite of 20 to 28 standard fluorinated organic compounds by liquid chromatography-mass spectrometry (LC/MS/MS) available from commercial laboratories reported as the analyses for the resulting perfluorinated carboxylates for C4 to C14 carbon chain length (TOP C4-C14); and
- e. Note that as analytical and instrumental improvements are made regarding the analysis for PFAS it is understood that some laboratories are increasing the standard suite which may assist you in distinguishing between the premises sources of PFAS and other potential sources; and
- f. Where TOP Assay is performed, quality assurance checks must include that oxidant exhaustion has not occurred (e.g. reanalysis to determine presence of fluorotelomer); and
- g. Groundwater bores are constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia (3rd edition); and
- h. Where comparisons are to be made of PFAS sediment concentrations between locations, incorporate determination on the < 63 micron size fraction and organic carbon content to allow standardisation.

To the extent possible, as detailed in the DSI reports, these requirements have been met.

10. A final Environmental Report (this document) must be submitted by Batchfire by **5:00 on 30 June 2024** that demonstrates that the requirements of this environmental evaluation have been completed. *This requirement has been met.*

1.2 SITE DESCRIPTIONS

The issued EEN includes mining activities carried out by Batchfire Callide Mine across land described as mining leases (ML), including land at Dunn Creek, the Hut, Trap Gully (collectively the Southern Operations area) and Boundary Hill.

The referenced land parcels are ML 80118, ML80093, ML80122, ML80107, ML80151, ML80115, ML80186, ML80117, ML5632, ML5641, ML5653, ML5654, ML5655, ML6993, ML6994, ML80030, ML700059 and ML80092 (Callide Coal Mine).

Lot and Plan numbers for the affected land is listed in Table 2.1 and the EMR status and notifiable activity of each land parcel is listed in Table 2.2 of each DSI report. All of the Lots are listed on the EMR, none of the Lots are listed on the CLR.

The Lots are:

Southern Operations:

- Lot 100 on SP301602 (Dunn Creek),
- Lot 31 on RN869 (Dunn Creek),
- Lot 23 on SP129150 (Dunn Creek)
- Lot 31 on RP899131 (Trap Gully),

- Lot 1 on SP200919 (Trap Gully),
- Lot 4 on SP328354 (Trap Gully), and
- Lot 170 on FTY1843 (the Hut).

Boundary Hill:

- Lot 153 on RN1431, and
- Lot 11 on RP801163

1.2.1 SOUTHERN OPERATIONS

The mining infrastructure area (MIA) for the Southern Operations area containing all the associated facilities for supporting the mine is located within the Dunn Creek mine area, with some mechanical works carried out at an open-air maintenance area and laydown apron located at Trap Gully.

The extent of the investigation area includes the Callide Southern Operations MIA, warehouse and workshop area including surface water locations and groundwater wells to the north and south of the workshops, the former Fire Training Area (FTA) and surrounding areas located to the south of the Dunn Creek mining pit, including Lake McCauley, the Rail Loop Pond, the Dunn Creek Dam and the East Dam. These facilities are shown in the site plan in *Figure A* below. The use of the former FTA ceased in 2018 and there is no current FTA at the Southern Operations area. Also included in the study area is the Trap Gully mining area, consisting of the Maintenance Laydown area, as well as the adjacent Ghost Ryders Dam and further east, the Goldings Dam. To the north of the Southern Operations, Dunn Creek pit area and the Hut mining pit known as the Central Valley North Pit (CVN Pit) have also been included, with the locations as shown in Figures 1, in Appendix A.

Most of the site surface in the operational area is unsealed, compacted earth. The unsealed areas to the north and south of the main workshop building are referred to as the 'maintenance apron area' where spent fluorinated AFFF was historically released to ground.

The former FTA is a bunded (earth bund), unsealed area located to the north-east of the main workshop. A small storage shed is located outside the south-east corner of the former FTA that historically was used to store firefighting equipment and AFFF product.

A large water tank is situated in an elevated position immediately north of the former FTA. The tank is connected to a hydrant pipeline which supplies water to the warehouse and workshop firefighting suppression system via underground pipelines. Water is supplied to this tank via a pump located at Lake McCauley.

There are eight surface water bodies located within the investigation area, including the southern holding pond, northern holding pond, Bathhouse Sediment Basin, Lake McCauley, Rail Loop Pond, Magazine Dam, East Dam and Dunn Creek Dam. The Southern Holding Pond is a static water body. Wastewater from the wash bays is directed to the northern holding pond. The Northern Holding Pond flows to the Bathhouse Sediment Basin, then to Lake McCauley, the Rail Loop Pond and the Dunn Creek Dam. The Magazine Dam and East Dam both flow to the Dunn Creek Dam. A drainage path from the water tanker filling point flows directly into Lake McCauley. Refer to *Figure A* below for the surface water flow directions around the MIA area.

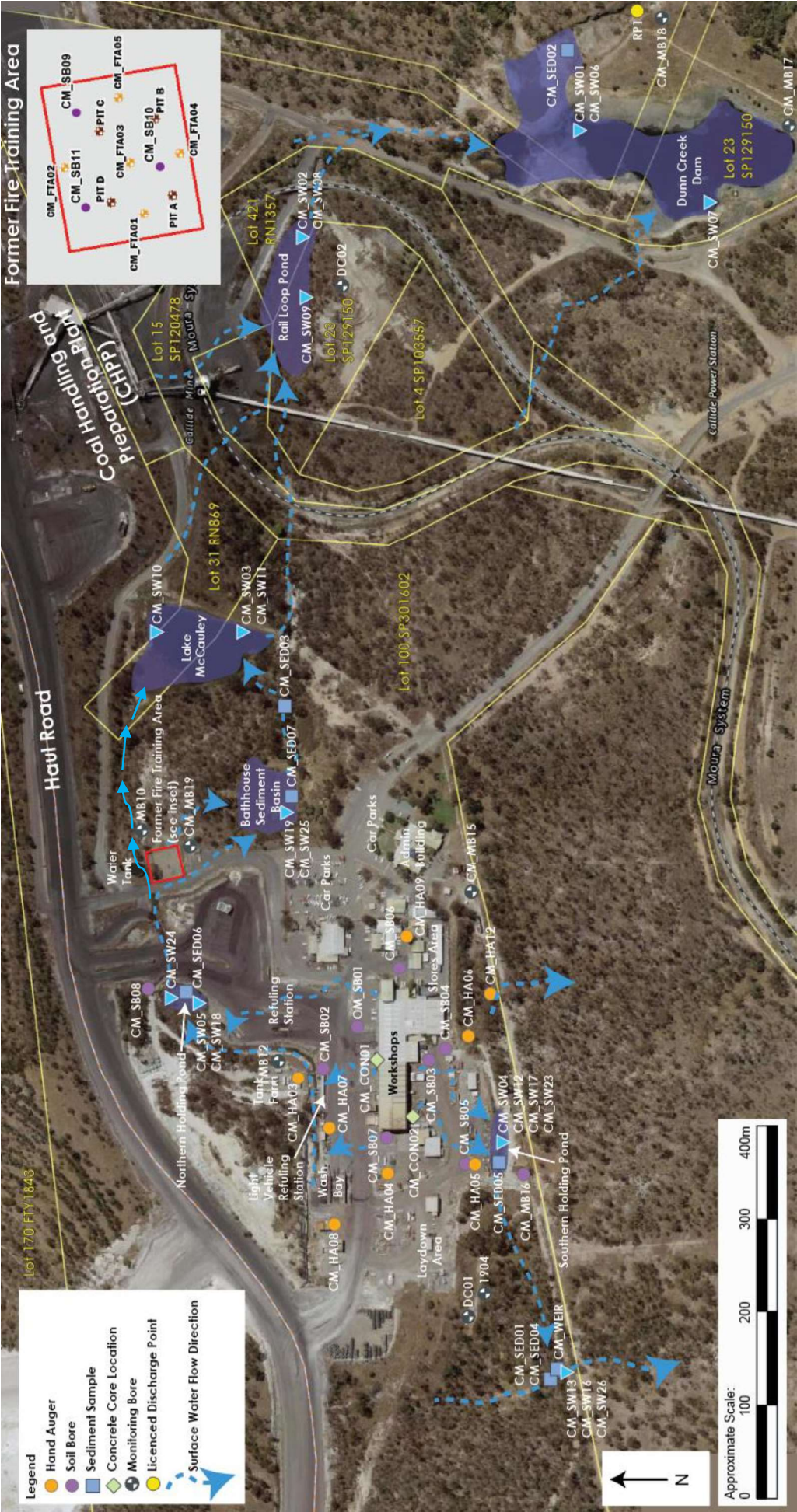


FIGURE A. SITE PLAN OF THE SOUTHERN OPERATIONS DUNN CREEK MIA, SAMPLING POINTS AND SURFACE WATER DRAINAGE PATHS

1.2.2 BOUNDARY HILL

The original Boundary Hill pit (known as the Boundary Hill north pit) was developed in 1984. Prior to the development of the Boundary Hill mine, the site was farmland, grazing land and forest reserve with no infrastructure evident. The boundary Hill mine operates as an independent mine and contains all the infrastructure associated with a mine site. Currently, the Boundary Hill South pit has been developed, as the northern pit is no longer mined. A haul road connects Boundary Hill to the rest of the Callide Mine and a Spine Pipeline runs adjacent to the haul road for the internal transfer of water between the various water storage dams and for industrial use within the site. A detailed map of sample locations and the MIA area is shown on *Figure B* below.

Surface water drainage from the admin/workshop area is directed to treatment ponds to the north of the workshops and then a series of sediment ponds, with final surface water discharged into Lake Gasteen, a large artificial water storage impoundment to the southwest of the main admin/workshop area. Stormwater runoff from the unsealed surface on the western side of the workshops may flow directly into Lake Gasteen. Refer to *Figure B* below for the surface water flow directions around the MIA area.

Coal stockpiling occurs in an area to the north-east of the maintenance/administration facility, with a conveyor belt system moving the coal to a coal handling plant and further stockpiling area located to the west. From the coal handling plant there is a loading facility where a rail loop exists for the purpose of removing the coal to an export terminal.

The former Fire Training Area (referred to as FTA1) was established slightly to the south of the coal conveyor system on raised ground (mine spoil) just north of Sediment Dam 2 (refer to *Figure 3a in Appendix A*). Steel trays containing scrap items and diesel fuel were set alight and extinguished using legacy fluorinated AFFF mixed with water. A small concrete slab located at FTA1 was used for the storage of small drums of AFFF. The surface run-off drained directly south to Sediment Dam 2 from FTA1 through gaps in the bund wall. Water from Sediment Dam 2 then drains further south to Lake Gasteen. A pump is installed at Lake Gasteen for the extraction of water for commercial/industrial uses within the maintenance area, such as for dust suppression and vehicle washdown. A vehicle washdown area is located to the north of the workshop area and drains to the treatment ponds.

The Boundary Hill site trucks in potable water. Groundwater from two off-site production bores known as Kilburnie 1 (RN62901) and Kilburnie 2 (RN62900) are used for shower water at the Bathhouse. The bore water was also used for infrastructure fire suppression and workshop wash-down purposes until 2023. At that time the source of water for infrastructure fire suppression and vehicle washdown was changed to Lake Gasteen. The Kilburnie 1 and 2 bores are located just to the south of the Boundary Hill South pit southern edge, approx. 2.8km southwest of the MIA.

A laydown area is located over 750m to the north of the main facilities of the site. This laydown area has been built up with mine spoil to serve as a laydown, mainly for drilling materials. In addition, the steel fire trays from FTA1 were moved to this location and reused for ongoing fire training, referred to as FTA2 (the current FTA) in this report. Only PFAS free AFFF compounds have been used at FTA2, with a single test pit carried out for confirmation sampling. A fire water line with hydrant fitted and overhead power lines run along the western edge of the laydown area in a north to south alignment.

The new FTA2 / laydown area sample location is not included in Figure B below but is able to be viewed in *Figure 3a* in *Appendix A*. The Boundary Hill pit void sample locations are not included in Figure B below but are able to be viewed in *Figure 3b* in *Appendix A*.

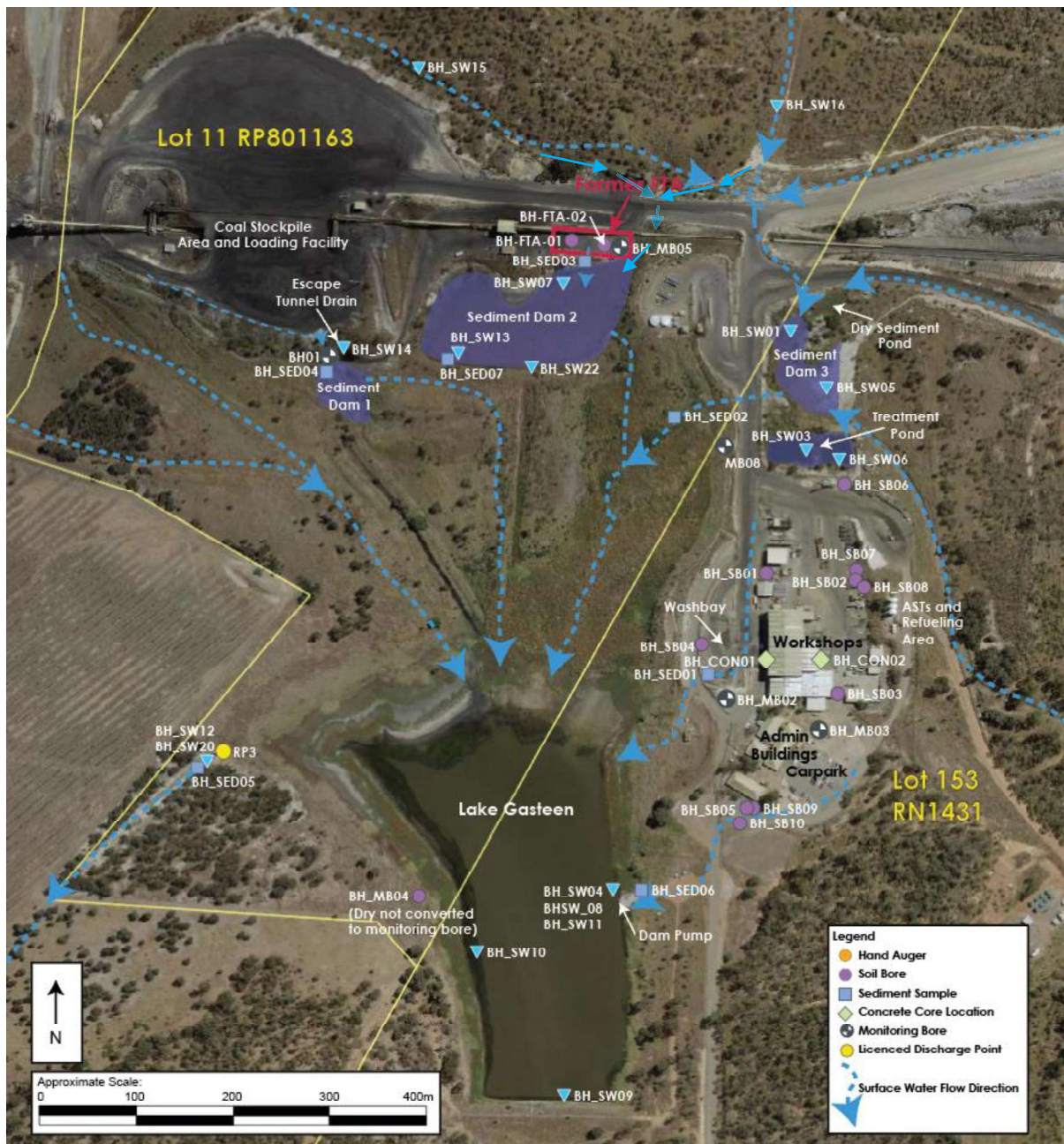


FIGURE B. SITE PLAN OF THE BOUNDARY HILL MIA, SAMPLING POINTS AND SURFACE WATER FLOW PATHS

1.3 REGULATORY CONTEXT

The DSI investigations have been carried out in accordance with the regulatory documents listed in the EEN:

- The Act – see <https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-1994-062>;
- The Policy – see <https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2019-0156>;

- Queensland Water Quality Guidelines (2009) – see <https://environment.des.qld.gov.au/management/water/quality-guidelines>;
- Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009 Version 2 September 2010 see - <http://www.ehp.qld.gov.au/water/pdf/monitoring-man-2009-v2.pdf>;
- National Environmental Protection (Assessment of Site Contamination) Measure 1999 – see <http://nepc.gov.au/nepms/assessment-site-contamination>;
- Guidelines for Contaminated Land Professionals – see <https://www.qld.gov.au/environment/pollution/management/contaminated-land>;
- Assessment of impact of human health considering the Tolerable Daily Intakes for PFOS, PFOA, and PFHxS recommended by Food Standards Australia New Zealand (FSANZ);
- Where PFAS are encountered in water bodies at the premise which are accessible to fauna such as birds and mammals, qualitative consideration of water to animal bioaccumulation factors reported in research publications concerning those contaminants in evaluating potential environmental harm to such animals; and
- Assessment of contamination considering guidance provided in the PFAS NEMP – see <https://www.qld.gov.au/environment/pollution/management/disasters/investigation-pfas/management-plan>

Additional reference materials sourced for the PSI and DSI reports are listed in Section 11, References.

1.4 OBJECTIVES

The objectives of this DSI were to further assess the site for the presence of PFAS in soil, sediment, surface water, and groundwater, to close out gaps identified in the draft Conceptual Site Model (CSM) and to meet the DSI reporting requirements of the EEN. Section 6 of the EEN directs that the sampling must determine the nature and extent of impact arising from any direct or indirect release of PFAS identified in the PSI in relation to the premises. Section 8 of the EEN states; The investigations required by this notice must meet the requirements for a CLID for the land in accordance with section 389 and 390 of the Act. A CLID must be prepared by a SQP as required by and in accordance with Chapter 12, Part 3 of the Act and be accompanied by an auditor certification that the CLID complies with section 389 (1), (2) and (4) of the Act. This document, while meeting the CLID requirements for an investigation into contaminated land at the site, only considers PFAS compounds as the contaminate of interest and no others. It is beyond the scope of the EEN to investigate other contaminants at the site, although Section 389 of the EP Act, which looks at the requirements of a CLID, states that 'all activities carried out that may affect the safety of the relevant land or cause environmental harm' (S. 389 (2) (a) (iii) (e)), this DSI report (both Part A and Part B) will only consider PFAS use and potential contamination as per the EEN scope requirements.

1.5 STATEMENT OF WORKS

The scope of work for the site investigations was developed from the Work Plan (PSI Work Plan and then DSI Work Plan), which incorporated a SAQP. Initially the two sites were treated as separate programs, however it became necessary to combine the reporting into a Part A - Southern Operations and Part B - Boundary Hill report for clarity, especially when dealing with the beneficial water that could be sourced from either site. The DSI Work Plan was prepared

following the PSI works, including a historical data review, desktop investigations, correspondence with Batchfire and PSI sampling results. In accordance with the EEN, the Work Plan was developed in stages, along with the development of a Conceptual Site Model (CSM), with subsequent stages building on the data gathered in earlier stages and feeding into the development of a more robust CSM. The investigation milestones for the investigation were as follows:

- In July 2021 ERM undertook a Preliminary Site Investigation (PSI) (ERM, 2022) across the Southern Operations investigation area, obtaining select soil, sediment, surface water and groundwater sampling of existing monitoring bores. The result of this work is outlined in full within the report in Appendix L.
- The original EEN (STAT-E-100078550) was issued to Batchfire on the 16th December 2021, with the most recent revision dated 16 October 2023.
- The Stage 1 (first round) DSI fieldwork was carried out between July and September 2022, comprising of drilling of new investigation groundwater monitoring bores across the site, as well as further sampling of soil, concrete, sediment, and surface waters.
- The Stage 2 (second round) DSI fieldworks were carried out in March 2023 to collect samples to further delineate soil results and to gather further data for surface water and groundwater modelling and delineation. The final Stage 2 samples were collected in July 2023.

In general, the field works included the following:

- Drilling soil bores at selected locations for the collection of soil samples at various depths to characterise the sites soil and the installation of groundwater monitoring wells at selected soil bores to characterise the sites groundwater and develop a conceptual groundwater model for the site (where groundwater is encountered). This work was undertaken in August 2022;
- Hand augering soil bores for the collection of shallow soil samples;
- Collection of surface water samples from dams, holding ponds, surface water flow paths and mine void pits;
- Development of new wells and collection of several rounds of groundwater samples from new and existing groundwater monitoring wells;
- Collection of sediment samples from selected locations along flow paths; and
- Collection of beneficial water samples from off-takes along the Spine pipeline that supply mine water to local landowners, and which connects various water storage dams across the Callide mine site's three main operational areas and the neighbouring Boundary Hill mine (also owned by Batchfire).
- Samples to be sent to NATA accredited laboratory under Chain of Custody (COC) procedures for analysis, including PFAS suites and with selected samples also analysed for TOF analysis, TOP Assy and ASLP;
- Sediment samples to be analysed for particle size distribution and <63 micron fraction.

2. ENVIRONMENTAL SETTING

2.1 HISTORICAL SETTING

The Callide Mine Southern Operations site was developed from a farmland and greenfield/forestry reserve prior to construction of infrastructure to support the mine site. The initial development of the Callide Mine began in approximately 1944 with development of the Dunn Creek pit. Callide A Power Station was constructed in 1965 and is approximately 250 m downstream of the Dunn Creek Dam. Callide B Power Station was constructed in 1988 and the Callide C Power Station was constructed in 2001, both the Callide B and C powerplants are approximately 1km south of the Main Workshop area. Trap Gully pit and the Hut pit were developed in 1981 and 1990 respectively, with the Boundary Hill north pit developed in 1984 (see the aerial photograph review in the PSI Report, ERM 2023). The Boundary Hill south pit commenced development in 2018. The Boundary Hill operations are located 18km north-west of the Southern Operations area. The Boundary Hill mine complex represents the northern most extent of the Callide Basin.

2.2 CLIMATE AND RAINFALL

Review of the Bureau of Meteorology (BOM) database for Thangool Airport (site 039089) on 11 June 2023 indicated that the area receives an average of 655.2mm annually with increased rainfall reported during summer. *Figure C* below shows rainfall data for 2021 to May 2023, which covers the full period of this investigation. Above average rainfall was generally recorded over the 2021 and 2022 wet seasons with higher-than-average totals recorded for both years. This is consistent with the prevalence of a La-Nina event on the Australian East Coast over this period. Batchfire made water management preparations for the Southern Operations site in advance of the 2022 wet season by lowering the water levels in the Magazine Dam and Dunn Creek Dam and de-silting the Magazine Dam to increase its water storage capacity. Lake Gasteen on the Boundary Hill site is lowered each year in preparation for the wet season.

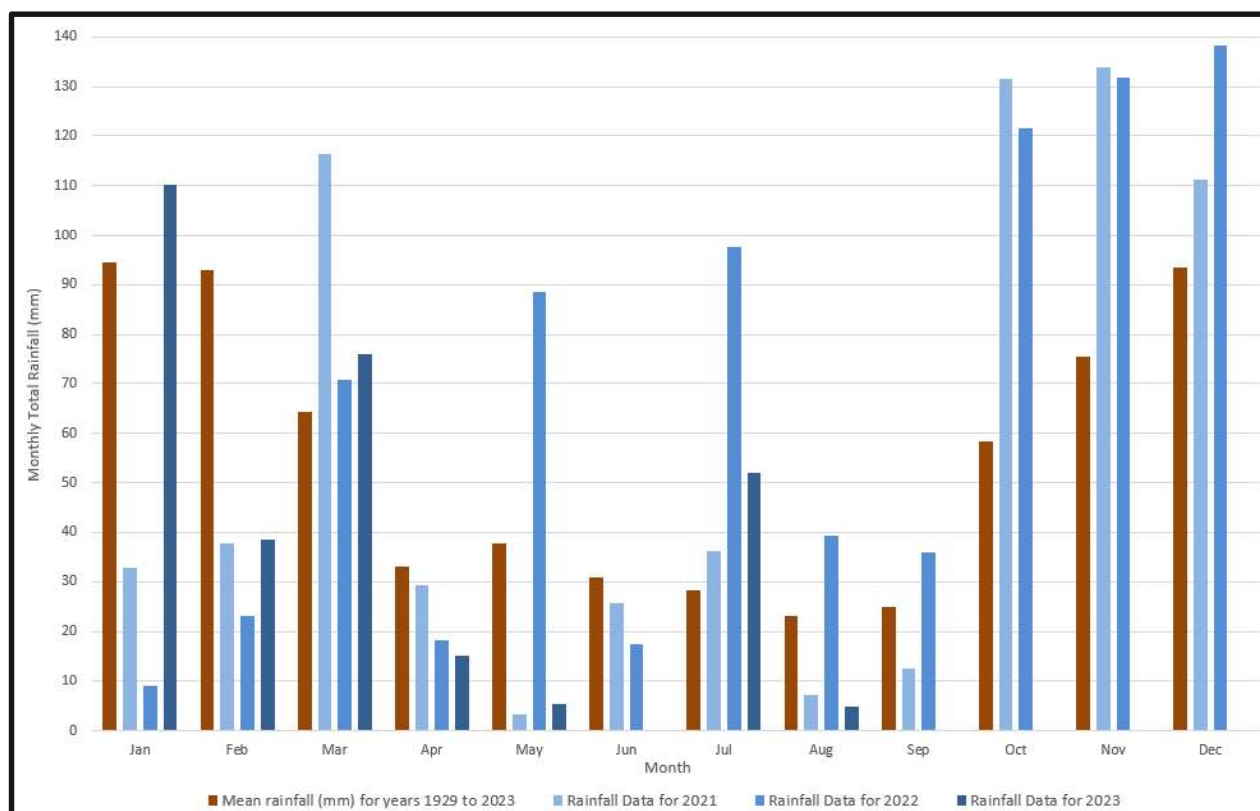


FIGURE C. MONTHLY RAINFALL AT THANGOOL AIRPORT, JANUARY 2021 TO AUGUST 2023 (BOM STATION 039089) THANGOOL AIRPORT

2.3 SITE TOPOGRAPHY

The topography of the Study Area was reviewed in the topographic map of Biloela (DNR, 2020) and the Queensland Globe Topographic map for Biloela.

2.3.1 SOUTHERN OPERATIONS

The topography of the Study Area was reviewed in the topographic map of Biloela (DNR, 2020). The elevation of the warehouse and workshop area ranges from 290-310 metres above Australian Height Datum (mAHD). The site slopes slightly from west to east in the northern and eastern portion of the site within the vicinity of the former FTA. Within the central and western area of the warehouse and workshop area the site slope slightly from north to south. The operational area of the site was generally level. Generally, the slope declines from the edge of the operational area towards the south. The landscape away from the MIA is hilly and incised by drainage and creek lines. The landscape to the north (with the exception of the Dunn Creek Pit) and east of the MIA rises to above 400 mAHD, with Mt Murchison to the west of the Dunn Creek Pit rising to 524 mAHD. Dunn Creek Dam is the lowest reservoir on the site and is the site of the RP1 permitted release point. The approximate level of this dam is 250 mAHD, below the dam, Dunn Creek flows south-east, then south, towards the Callide Dam, which has an approximate level of 210 mAHD (variable depending on the prevailing weather and release schedules).

2.3.2 BOUNDARY HILL

The elevation of the Boundary Hill mine ranges from 240 metres above Australian Height Datum (mAHD) in the east of the site to approximately 190mAHD at the base of Lake Gasteen (State of Queensland (Department of Natural Resources, Mines and Energy (DNRME)), 2020). Lake Gasteen is a valley fill catch dam located in the former channel of Gate Creek. The site topography slopes towards the south-southwest along the general path of Gate Creek. There are several low hills reaching heights of up to 250 mAHD several kilometres to the west of the MIA. A drainage line named Campbells Creek is located to the south of the site, and runs east-west, adjoining Gate Creek approximately 1.3 km south of Lake Gasteen, this drainage line starts adjacent to the Boundary Hill South Pit.

2.4 SITE HYDROLOGY

Both the Southern Operations site and the Boundary Hill site have managed hydrology systems, which include the provision of sediment basins and water storage dams. Controlled releases are allowed under the EA, however, the water storage dams are managed by Batchfire to prevent releases. Designated Release Points are: RP1 at the Dunn Creek Dam spillway (Dunn Creek site), RP1a at the Turkey's Nest Dam (The Hut), RP2 at Goldings Dam (Trap Gully) and RP3 at the Lake Gasteen spillway (Boundary Hill).

2.4.1 SOUTHERN OPERATIONS

The hydrology was briefly mentioned in Section 1.2.1, outlining the water storages of the Southern Operations. The interconnections of the surface water features showing the surface water flow paths around the MIA provided in Figure A above and on Figure 2a in Appendix A. There are two water retention ponds located within the boundary of the main operational area, to the north (Northern Holding Pond) and south (Southern Holding Pond) of the main workshop building. The retention pond to the north collects surface water draining from the northern portion of the operational area, including the vehicle wash bays, light vehicle refuelling area and the main truck refuelling area, prior to flowing east under the road and into the Bathhouse Sediment Basin near the former FTA. The retention pond to the south (Southern Holding Pond) collects surface run-off from the southern apron of the main workshop building.

Water storage associated with Dunn Creek mining activities located within the investigation area includes Lake McCauley and Dunn Creek Dam. These are used to supply the mine, manage surplus water from mining operations, to accommodate wet weather flows and to manage controlled releases at RP1 (Dunn Creek Dam) if required, in compliance with Environmental Authority (EA) conditions.

Water from Lake McCauley is used to fill water tankers for road construction and maintenance. Water is also pumped from Lake McCauley to a storage tank servicing the coal handling plant (CHP) and associated water tanks and vehicle wash down area. Water is decanted from East Dam to Lake McCauley to keep Lake McCauley topped up for water cart operations. Lake McCauley also receives water pumped from Magazine Dam and Dunn Creek Dam if required. Water at Lake McCauley is used for dust suppression, workshop use, vehicle wash down, CHP and maintenance of haul roads.

The Rail Loop Pond is considered a coal-impacted run-off pond and receives surface water run-off from the CHP area and coal load out facility and northern part of the rail loop. Water from Rail Loop Pond drains to Dunn Creek dam.

The use of mine affected water within the Dunn Creek mining lease is limited to use in areas located up stream of Dunn Creek Dam. The discharge point of the Dunn Creek Dam is an approved controlled release point (RP1), included in the site's Environmental Authority (EA).

Drawings provided by Batchfire and illustrated in *Figure A* above and Figures 2a-2c, in Appendix A show surface water flows within the investigation area via creeks and drainage lines towards the south / south-east from north of the haul road and east to west across the maintenance area of the site, discharging to a sediment basin and three small surface water bodies (Bathhouse Sediment Basin, Lake McCauley, Rail Loop Pond and Dunn Creek Dam). Surface water north-east of the Rail Loop flows toward Magazine Dam, and then south-west to Dunn Creek Dam. Overflow water from East Dam, flows west towards Dunn Creek Dam. Surface water can currently flow offsite from the southern boundary of the maintenance area in a southerly direction towards the rail line easement.

The investigation area is located within the Callide Creek catchment area. Releases from Dunn Creek Dam have not occurred since March 2017, however would flow south, from the permitted release point RP1 to the east of the decommissioned Callide A Power Station, and into Callide Dam, approximately 2.5km to the south-east of the Mining Lease boundary. There are currently two flow paths to the south. approx. 320m to the west-southwest of the workshop where a concrete weir has been installed, and the approx. 120m to the southeast of the workshop. These drainage lines only flow during heavy rainfall events.

2.4.2 BOUNDARY HILL

The hydrology was briefly mentioned in Section 1.2.2, outlining the water storages of the Boundary Hill mine. The interconnections of the surface water flow paths around the MIA area shown on *Figure B* above.

Drawings of the investigation area provided by Batchfire show surface water flows via creeks and drainage lines directing flows towards Lake Gasteen. Water bodies are connected by drains beneath roads within the site. There are three sediment dams located north of Lake Gasteen, these have been labelled Sediment Dams 1-3 on Figure B above and on Figure 3a, Appendix A. The Boundary Hill northern pits are shown on Figure 3b.

There is also a Treatment Pond located to the north of the main workshop and maintenance areas of the site, including the wash bay. These ponds appeared to be separate in overhead images; however, when on site, a 2-3m wide gap was observed in the separating wall and the two ponds were sampled as one at a location adjacent to the gap in the wall. This pond discharges to Lake Gasteen.

Sediment Dam 3 is located to the north of the Treatment Pond and accepts surface water flows from the north and east of the site, including pit access roads and the northeast coal stockpile area. It acts to reduce sediment loading prior to the water flowing via an underground pipe to Lake Gasteen. Only minor flows were noted at Sediment Dam 3 at the time of sampling, with the surface water sample collected from a sump at the outflow pipe.

Sediment Dam 2 receives runoff from the FTA1 area and drains directly into Lake Gasteen. Sediment Dam 1 receives runoff from the Coal Stockpile loadout area to the northwest of the MIA and this sediment dam drains directly into Lake Gasteen.

Lake Gasteen is the final receiving water body within the site. This lake was created as a valley fill catch dam located in the former channel of Gate Creek. Any overflow from Lake Gasteen (under EA conditions) would flow to the west, over a weir on the outflow channel at Release Point 3 (RP3) and then via an overland path that eventually turns south and east and discharges into Gate Creek. Gate Creek joins Callide Creek approximately 10km south / downstream of Lake Gasteen. During the December 2021 site visit, the overflow area, which is a naturally low-lying area, was inundated from recent heavy rains, and the outflow channel could not be accessed for sediment sampling. Later sampling rounds collected both surface water and sediment samples from the outflow channel of Lake Gasteen. The Lake Gasteen catchment collects water from the Boundary Hill train load-out facility, the coal stockpile area, the Boundary Hill MIA, the western slopes of the overburden emplacement area including non-mining catchment areas from adjacent land tenures not owned by Batchfire.

A pump is fitted at Lake Gasteen for the reuse of water within the mine site for dust suppression and wash-down purposes. In addition, water from Lake Gasteen was previously supplied to off-site landowners under a beneficial water reuse agreement, for non-domestic uses (e.g. crop irrigation and stock watering). Below Lake Gasteen, the Unnamed Landholder Dam on Gate Creek is connected to the Beneficial Water Supply network and previously received water directly from a siphon pipe from Lake Gasteen. The siphon pipe has now been replaced with a new pipeline connected to the Boundary Hill's pit water. Since fluorinated AFFF was phased out in 2019, the pit water is not believed to have PFAS present and the DSI results support this with the two northern pit samples returning results less than the LOR for PFAS. Potable water for the Boundary Hill MIA is trucked in.

Site run-off and water in Lake Gasteen is managed as part of the site Water Management System (WMS) as described in Section 7.1 of the Callide Mine Water Management Plan (2023). The Callide Mine has a Receiving Environment Monitoring Program (REMP) (HEC, 2023) which includes information on the physical and ecological condition of the receiving environment. There is a permitted EA release point (RP3, shown on Figures 3a - 3b in Appendix A and *Figure B* above) at Lake Gasteen and discharges from this release point are required to comply with EA Condition C4. In addition, receiving waters immediately downstream of release points must be monitored to comply with EA Condition C19. There have been no water releases from Lake Gasteen since March 2020.

3. SITE ASSESSMENT COMPLETED TO DATE

ERM has carried out a PSI and DSI of the Batchfire Callide Mine sites. Since Batchfire groups their mine site into two independent operations, the reporting was also divided into Part A (Southern Operations) and Part B (Boundary Hill) DSI reports for clarity. The DSI reports contain their respective PSI report in an appendix in each report. Sampling at each site included soil, sediment, concrete, surface water and groundwater. Four additional groundwater monitoring wells were installed at each site as part of the DSI to ensure there was adequate sampling of the aquifers present beneath each site. A summary of the sampling for each site is provided in Sections 3.1 and 3.2 below. Work plans, including sample analysis and quality plan (SAQP) were developed for each site and may be viewed in Appendix B of this report.

In order to build a robust CSM, media to be sampled must include those present at the source (soil and concrete), those present in potential pathways (surface water, groundwater, soil and sediment) and the concentrations of PFAS compounds at the site boundaries where potential migration of PFAS may occur (soil, sediment, surface water and groundwater). Various analytical techniques should be employed to ensure that adequate characterisation has been achieved, including leaching tests, TOP assay and TOF analysis. The draft CSM should explore all available migration pathways for PFAS.

The results of the sampling carried out informed the refinement of the draft Conceptual Site Model (CSM) from the PSI to DSI. Details of the CSM are discussed in Section 6 of this report. Discussion on the distribution of PFAS within each site is found in Section 7 of this report. Where the sampled media at the site boundary exceeds the adopted site criteria then it must be assumed that there is potential for off-site exposure to occur and this may trigger the sampling of adjacent sites. Discussion on PFAS risk assessment and mitigation measures is found in Section 8 of this report. Sampling locations for the Southern Operations are shown in Figures 2a-2d in Appendix A. Sampling locations for Boundary Hill are shown in Figure 3a and 3b in Appendix A. Sampling locations for the beneficial water for both sites are shown in Figure 4 in Appendix A.

3.1 SOUTHERN OPERATIONS

Sediment samples were collected from shallow scrapings (after clearance of surface organic matter) in flow paths using a stainless-steel trowel that was decontaminated between uses. The rationale being that the collection of shallow material is representative of material that may be mobilised during high rainfall events when aggressive runoff may scour the upper layer and transport the entrained material off site. Sediment sample locations were selected within flow paths that have the potential for mobilising sediment off the site.

Soil samples were collected by one of two methods, either using a hand auger where depths were not expected to be greater than 0.5-1.0m or by the use of a Geoprobe drilling rig with rotary augers where greater depths were desired. Both the hand auger and the rotary augers were decontaminated by washing with a PFAS Free non-ionic surfactant and hosing off between uses. The rationale for the collection of soil samples within the site was targeting the areas with a potential for release of PFAS products (workshops and former FTA) and the potential pathways that PFAS may have taken to reach flow paths and water bodies within the site. Depth samples were collected to assess PFAS infiltration from the surface and the potential for contamination of groundwater beneath the site. Selected samples were subjected

to leaching tests. Cross contamination was addressed by thorough washing of the solid flight augers between bores and collecting soil samples within the undisturbed material within the auger after removing the outer layer of smeared soil. The decontamination procedure for reusable equipment is detailed in Section 5.1.1.1 of the Work Plan and may be viewed in Appendix B.

One additional location was identified for soil sampling during the DSI, a location within the Dunn Creek Pit area where potentially impacted material had been stockpiled prior to off-site disposal by a licensed contractor. The material was scraped from the Southern Holding Pond after initial sampling results from the PSI sampling program indicated that the soil and water in the southern holding pond were impacted with PFAS.

Concrete samples were collected to assess the impact of PFAS products released on the concrete aprons of the workshop area. The rationale was to confirm if the concrete may act as a secondary source by storing PFAS products and releasing PFAS over time. Cores were cut from the aprons on both sides (northern and southern) of the workshop and both upper surface and lower surface samples were collected. Selected concrete samples were subjected to leaching to evaluate this potential mechanism.

Surface water samples were collected from both water storage dams and surface water flow paths when water was available, during several sampling events. The sites flow paths are usually intermittent, relying on rainfall events to create a flow. The surface water dams are linked by both flow paths and by pipes that allow water to be transferred by pumping between dams and from the sites mine void pits. The rationale for multiple sampling events of both flow channels and dams is that sampling of the flow paths alone would not be sufficient to establish the potential water quality in the dams and a single dam sampling event would not be sufficient to capture the potential variability over time from mixing water from different areas of the site by pumping activities.

The sites mine void pits were also sampled where they were accessible to establish if the source of much of the sites stored water was impacted by PFAS products. The rationale for sampling the mine void pits is that the inflow water to these pits is mostly groundwater from intersected aquifers and rainwater that collects in the pits as they are the lowest points. However, there is a potential for PFAS to be present in the pit water if an equipment or mobile plant fire occurred within the pit and was controlled using AFFF containing PFAS and water mixture. Surface water runoff from such an event would drain into the pit water and PFAS impacted soil may continue to leach PFAS to the pit water over an extended time frame.

Groundwater samples were collected over several sampling events. Initially, the site had a limited number of groundwater monitoring bores installed (five) and these targeted different aquifers. One of these bores, 1904, was also known to be dry at times. Four additional groundwater monitoring bores were installed to ensure that the sites aquifers were adequately characterised and modelled. Since the groundwater both flows through aquifers and is subject to seasonal recharge and depletion, multiple sampling events were used to capture temporal data over an extended period. The rationale for this is that the movement of the sites groundwater in each aquifer present needed to be understood for the drafting of a conceptual groundwater site model that could identify the potential for PFAS impacted groundwater to migrate off-site. All groundwater samples were obtained using a PFAS free Hydrasleeve sampler, however each bore was first purged using a 12v pump that was decontaminated

between bores and fitted with new tubing. This was done to assist development the bore and would allow for a higher quality sample to be obtained through clearing out of fines within the gravel pack. A minimum of 3 well volumes were purged or until the bore went dry. The bore was allowed to settle for up to a week, before the sample was collected using a Hydrasleeve, left in place for at least 24hrs prior to sampling. All subsequent samples rounds had Hydrasleeve set up prior to sample collection (set up following the previous sampling).

Beneficial water (BW) is supplied from the Batchfire mine to local landowners for irrigation and stock watering (non-domestic uses). Several off-takes have been fitted to the spine pipeline that runs between many of the sites water storage dams, water may be pumped from any individual dam or from several dams at once. Many of these off-takes have been fitted with flow meters and sample taps. The results of sample analysis of Beneficial Water supplied to landowners from the Spine pipeline off-takes within the Southern Operations are reported in the Southern Operations DSI report (DSI Report Part A).

A summary table (Table 5-1) of the investigation rationale including media, potential sources, PSI/DSI sampling rounds and sampling rationale and methods for characterisation is included below. The sampling outlined below in Table 5-1 meets the requirements of the DSI sampling strategy put forward within the Work Plan, a copy of which is saved in Appendix B.

3.2 BOUNDARY HILL

Sediment samples were collected from shallow scrapings (after clearance of surface organic matter) in flow paths using a stainless-steel trowel that was decontaminated between uses. The rationale being that the collection of shallow material is representative of material that may be mobilised during high rainfall events when aggressive runoff may scour the upper layer and transport the entrained material off site. Sediment sample locations were selected within flow paths that have the potential for mobilising sediment off the site.

Soil samples were collected by one of two methods, either using a hand auger where depths were not expected to be greater than 0.5-1.0m or by the use of a Geoprobe drilling rig with rotary augers where greater depths were desired. Both the hand auger and the rotary augers were decontaminated by washing with a PFAS Free non-ionic surfactant and hosing off between uses. The decontamination procedure for reusable equipment is detailed in Section 5.1.1 of the Work Plan and may be viewed in Appendix B.

The rationale for the collection of soil samples within the site was targeting the areas with a potential for release of PFAS products (workshops and former FTA1) and the potential pathways that PFAS may have taken to reach flow paths and water bodies within the site. Depth samples were collected to assess PFAS infiltration from the surface and the potential for contamination of groundwater beneath the site. Selected samples were subjected to leaching tests. Cross contamination was addressed by thorough washing of the solid flight augers between bores and collecting soil samples within the undisturbed material within the auger after removing the outer layer of smeared soil.

Concrete samples were collected to assess the impact of PFAS products released on the concrete aprons of the workshop area. The rationale was to confirm if the concrete may act as a secondary source by storing PFAS products and releasing PFAS over time. Cores were cut from the aprons on both sides (eastern and western) of the workshop and both upper surface and lower surface samples were collected. Selected concrete samples were subjected to leaching to evaluate this potential mechanism.

Surface water samples were collected from both water storage dams and surface water flow paths when water was available, during several sampling events. The sites flow paths are usually intermittent, relying on rainfall events to create a flow. The surface water dams are also linked by flow paths and by pipes that allow water to be transferred by pumping between dams and the mine site void pits. The rationale for multiple sampling events of both flow channels and dams is that sampling of the flow paths alone would not be sufficient to establish the potential water quality in the dams and a single dam sampling event would not be sufficient to capture the potential variability over time from mixing water from different areas of the site via pumping activities.

The sites mine void pits were also sampled where they were accessible to establish if the source of much of the sites stored water was impacted by PFAS products. The rationale for sampling the mine void pits is that the inflow water to these pits is mostly groundwater from intersected aquifers and rainwater that collects in the pits as they are the lowest points. However, there is a potential for PFAS to be present in the pit water if an equipment or mobile plant fire occurred within the pit and was controlled using AFFF containing PFAS and water mixture. Surface water runoff from such an event would drain into the pit water and PFAS impacted soil may continue to leach PFAS to the pit water over an extended time frame.

Groundwater samples were collected over several sampling events. Initially, the site had a limited number of groundwater monitoring bores installed (three), which targeted different aquifers. Four additional groundwater monitoring bores were installed to ensure that the sites aquifers were adequately characterised and modelled. A fifth groundwater monitoring bore (BH_MB04) that was drilled on the western bank of Lake Gasteen was dry and was backfilled after obtaining soil samples. Since the groundwater may be subject to seasonal recharge and depletion, multiple sampling events were used to capture temporal data over an extended period. The rationale for this is that the movement of the sites groundwater in each aquifer present needed to be understood for the drafting of a groundwater conceptual site model that could identify the potential for PFAS impacted groundwater to migrate off-site. All groundwater samples were obtained using a PFAS free Hydrasleeve sampler, however each bore was first purged using a 12v pump that was decontaminated between bores and fitted with new tubing. This was done to assist development the bore and would allow for a higher quality sample to be obtained through clearing out of fines within the gravel pack. A minimum of 3 well volumes were purged or until the bore went dry. The bores were allowed to settle for up to a week before the sample was collected using a Hydrasleeve, left in place for at least 24hrs prior to sampling. All subsequent sample rounds had a Hydrasleeve set up prior to sample collection (set up following the previous sampling).

Beneficial water (BW) is supplied from the Batchfire mine to local landowners for irrigation and stock watering (non-domestic uses). Several off-takes have been fitted to the spine pipeline that runs between many of the sites water storage dams, water may be pumped from any individual dam or from several dams at once. Many of these off-takes have been fitted with flow meters and sample taps. The Spine Pipeline and off-takes to landowner properties are shown on Figure 4 in Appendix A. The results of sample analysis of Beneficial Water supplied to landowners from the Argoon Hill tank (water previously sourced from Lake Gasteen) are reported in the Boundary Hill DSI report (DSI Report Part B).

A summary table (Table 5-1) of the Boundary Hill investigation rationale including media, potential sources, PSI/DSI sampling rounds and sampling rationale and methods for

characterisation is included below. The sampling outlined below in Table 5-1 meets the requirements of the DSI sampling strategy put forward within the Boundary Hill Work Plan (Appendix B).

4. FIELD INVESTIGATION RESULTS AND OBSERVATIONS

Field notes were made during each day of site works, including logs of new groundwater bores and soil bores by machine or hand auger. Where issues were encountered these were noted and any deviation from the proposed Work Plans were also noted. Samples collected were also recorded in the field notes prior to filling in COC forms for laboratory analysis.

Some observations of note for each site are detailed below in Sections 4.1 and 4.2. Sample results for both sites may be viewed in the data tables in Appendix C.

4.1 SOUTHERN OPERATIONS

The MIA has a variety of surface materials present, the western end of the main workshop is on a rock outcrop while the eastern end is on compacted fill material due to a small valley having been originally present at this location. On the northern and southern sides of the workshop are highly reinforced thick concrete aprons. Bare soil areas surrounding the workshop have been filled with a clay/gravel/rock mixture that has been compacted in place to support the movement of heavy vehicles. Further to the north of the workshop, a low-lying area, which includes the former FTA, has been filled/levelled with a combination of 'mine spoil' (from blasting sandstone) and capping using undersize screen reject material sourced from 'The Bluff'.

While this surface material was able to be penetrated by the drill rig auger and excavator bucket, where a hand auger hole was attempted, the penetration depth was usually limited to near surface only due to refusal on rocks, compacted clay and gravel and therefore limited to the collection of near surface samples only.

The concrete samples were obtained from outside Bay 8 (CM_CON01) on the north side of the workshop and outside Bay 12 (CM_CON02) on the south side of the workshop. No staining (other than tracked soil) was visible in the near area. The area was brushed off prior to coring to remove loose soil. Samples were obtained after coring by using an electric hammer drill fitted with a chisel, which was decontaminated before each use, pieces of upper and lower surface were discarded to avoid soil contamination of the sample.

Due to access to the workshops by mine haul trucks, the concrete aprons are quite thick, the cores were measured at 0.35m at CON01 and CON02. The concrete was in good condition despite the number of heavy vehicles that frequently traverse it. The concrete was also reinforced by fine tensile wire strands throughout its thickness. This created difficulty in detaching sufficient small concrete chips for collecting a sample.

Three PSI (CM_SED01 to CM_SED03) and seven DSI sediment samples were collected:

- CM_SED01 – at the weir of the southwestern flow path just before the southern boundary of the site. A coarse rock structure just before the concrete weir slows the surface water runoff and allows sediment deposition above the weir, the sediment was moist, fine grained and appeared to contain a high proportion of organic matter.
- CM_SED02 – in the outflow channel of the Dunn Ck Dam, which is an approved release point for site water (RP1). Sample collected from before the indicated RP1 location. Outflow from this RP will eventually join water held in Lake Callide. The outflow channel

was dry at the time of sample collection, with coarse sand and gravel noted but little organic matter.

- CM_SED03 – on the edge of a flow path between the Bathhouse Sediment Basin and Lake McCauley. Water was present in the flow channel and this sample was very moist. The area was vegetated, and roots and other organic matter was present in the sediment.
- CM_SED04 – at the weir of the southwestern flow path just before the southern boundary of the site. This sample is a temporal verification of the PSI sample, CM_SED01, collected one year after the original sample.
- CM_SED05 – collected from the inside wall of the southern holding pond to the south of the main workshop above the waterline. The holding pond was excavated to bedrock and the walls are believed to be natural soils displaced from the excavation and used to build up the capacity of the holding pond. Surface water runoff from the south side of the workshop is retained by this pond. The sample was moist with high proportions of clay and sand and medium size gravel.
- CM_SED06 – collected from the side wall of the Northern Holding pond. The holding pond retains surface water runoff from the northern side of the workshop, but also collects runoff from the wash bays and heavy and light vehicle refuelling areas. The pond is fitted with a hydrocarbon treatment/separator system and overflow water from this pond flows to the Bathhouse Sediment Basin via an underground pipe for further treatment. The sample was moist, very dark silty clay and sand and may have been impacted by hydrocarbons.
- CM_SED07 – collected from the edge of the Bathhouse Sediment Basin, near the inflow pipe from the northern holding pond. The sediment basin has a dense growth of reeds and water must flow through the reed beds to reach the outflow channel that leads to Lake McCauley. Due to water present in the sediment basin, this sample was very moist and contained clay, sand and organic matter.
- CM_SED08 – collected from the overflow channel of the Dunn Ck Dam, after the RP1 location. This sample is a temporal verification of the PSI sample, CM_SED02, collected one year after the original sample. The sample was mainly coarse sand and gravel, little organic matter was noted.
- CM_SED09 – collected from near the base of the Magazine Dam, which had been dewatered and was in the process of being de-silted in preparation for the wet season. This sample was very moist and silty with minor clay and fine sand present. The Magazine Dam collects surface water runoff from the northern end of the coal stockpile area and directs overflow via surface water flow paths to the Dunn Ck Dam.
- CM_SED10 – collected from the wall of the East Dam, just above the water line. This sample was very moist, sandy clay with some medium gravel and contained organic matter. The East Dam collects surface water runoff from the eastern end of the Dunn Ck mining area and directs overflow water via surface flow paths to the Dunn Ck Dam.
- CM_WEIR – collected from the surface flow path southwest of the workshop at the weir during the final round of the DSI sampling. This sample is a temporal verification of the DSI sample, CM_SED04, collected one year after that sample. CM_SED04 was itself collected one year after the original CM_SED01 sample. The sediment was moist, dark, fine grained silt and sand and appeared to contain a high proportion of organic matter.

At Trap Gully, the two PSI (TG_SED01 and TG_SED02) and three DSI sediment samples were collected:

- TG_SED01 – within the Trap Gully lay down area where water had ponded and deposited sediment before drying out, SED01 is at the western end.
- TG_SED02 – within the Trap Gully lay down area where water had ponded and deposited sediment before drying out, SED02 is at the eastern end.
- CM_TGSED03 – on the wall of the Ghost Ryders Dam, which is the main water detention dam at Trap Gully. This water may also be used for refilling the water trucks at the nearby water refilling point.
- CM_TGSED04 – On the wall of the Goldings Dam. This dam collects surface water runoff from the Trap Gully pit works area and may release water from the approved Release Point 2 (RP2) from where it will flow off-site to the south.
- CM_TGSED05 – on the floor of the Trap Gully Sediment Pond flow pathway, just before the water enters the pond. The sediment pond collects surface water flows from the southeast areas, including the Trap Gully laydown area and the water truck refilling point.

At the Hut, a single DSI sediment sample was collected:

TH_SED01 – at the base of a flow path leading from the Oaky Creek Diversion Dam into Oaky Creek. Water from the Turkeys Nest dam release point (RP1a), surface water runoff from the Hut pit workings and the headwaters of Oaky Ck flow into the diversion dam. The flow path was dry at the time of sample collection.

Surface water samples were collected either by lowering a container on an extendable pole into the water, approx. 1-1.5m from the shoreline and then decanting into the sample container or by directly immersing the sample container into the water body. Surface water bodies, with the exception of the northern holding pond were mostly clear water with minor organic matter such as algae present. The northern holding pond water adjacent to the oil water separator was dark and had a sheen close to the edge of the pond that was avoided when sampling. Flow path water tended to be siltier, although the water was not flowing, the nature of the water lying shallow in pools along the flow path meant it was easily agitated by wind effects.

On the Callide Mine, the Southern Holding Pond is a static dam, which collects surface water runoff from the southern side of the workshop. Water loss from this pond may be due to evaporation as the base of the pond is on bedrock believed to have low permeability. If this pond should overflow during an extreme rainfall event, or if any surface flow bypasses this pond, water would be directed to the southwest and may flow off-site to the south across private property via the same drainage channel containing the concrete weir. The Southern Holding Pond was not observed to be overflowing during any of the site visits, a previous flow path to the southwest on the graded track leading towards the DC01 monitoring wells was evident at that time, however this area also drains through the concrete weir.

The remaining surface water retention systems are linked by either pipes or surface water flow paths. These consist of the Northern Holding pond, which collects surface water from the northern side of the workshop, vehicle wash bays, light and heavy vehicle refuelling areas and

heavy vehicle parking areas. The northern holding pond is fitted with a water treatment system for the removal of liquid phase hydrocarbons. Water discharges via an underground pipe to the Bathhouse Sediment Basin, a shallow reed filled filtering basin. Overflow from here is via a surface water channel that directs the flow to Lake McCauley, this lake is connected to the spine pipeline pumping system. Lake McCauley has always appeared to be clear water with no odour or sheen, ducks have been observed on two occasions.

Overflow water from Lake McCauley is via surface channels that pass through the Rail Loop Pond on the way to the Dunn Creek Dam. The Rail Loop Pond is essentially a sediment settling pond for water runoff from the coal handling plant slightly to the north of the pond. The Rail Loop Pond has been observed to be highly silted with black material at every sampling event. During the July 2023 site visit this dam was discharging water into the flow path leading to the Dunn Creek Dam.

Two other dams that store surface water captured from site surface water runoff, the Magazine Dam and the East Dam, both direct overflow water to the Dunn Creek Dam via surface channels, where there is a permitted release point, RP1 (although there have been no releases since March 2017). The Magazine Dam is located at the northeastern end of the coal stockpile area and receives surface water runoff from stockpile pads and haul roads, while the East Dam is located at the base of a vegetated slope at the eastern edge of the surface water catchment and receives surface water runoff from that slope. The Magazine Dam, East Dam and Dunn Creek Dam are connected to the Spine pipeline pumping system.

While most dams and ponds were sampled multiple times, the Magazine Dam was sampled only once due to being dewatered for desilting activities during the first sampling round in July 2022. This is not expected to be an issue since this water reports to the Dunn Creek Dam, which was sampled three times. The East Dam and Dunn Creek dam have always been observed to be clear water with no odour.

All dams and ponds were below their maximum capacity at each sampling event with no dam overflows occurring, including at RP1. Surface water was noted as flowing from the Bathhouse Sediment Basin into Lake McCauley and from the Rail Loop Pond into Dunn Creek Dam in July 2021. A photographic log may be viewed in Appendix D. Where surface water samples were collected, field parameters were also measured using a calibrated YSI Pro Plus water quality instrument, with the exception of the CM_Overpass Dam sample, which was tested using a calibrated TPS WP81 water quality instrument which does not measure Oxidation Reduction Potential (ORP) and Dissolved Oxygen (DO). The field parameters may be viewed in Table 3b in Appendix C. Table 3b includes a sample location description and comments section for site observations.

All surface water samples were analysed for PFAS, at super ultra trace LOR's. Five samples, all from the DSI rounds, were selected for TOF analysis. Six PSI samples and seven DSI round samples were selected for TOP Assy. The tabulated surface water PFAS and TOF analysis results may be viewed in Table 7a and surface water TOP Assy results viewed in Table 7b in Appendix C.

At the commencement of groundwater sampling, each monitoring well is gauged using an electronic dipper. The groundwater gauging results for all groundwater sampling events during the PSI and DSI may be viewed in *Table 2 in Appendix B*. For the final two sampling rounds, September 2022 and March 2023, all monitoring wells, with the exception of DC01, had

reduced Standing Water Levels (SWL). DC01's SWL rose by 2.771m, this result could be an anomaly, given most results were around 27.5 mBTC for DC01, however the September 2022 result was 30.2 mBTC. As the conceptual model uses the March 2023 result for site groundwater level analysis, this unusual result in September 2022 will not impact on analysis. Further measurement of groundwater levels in the future will determine if this result is an outlier. The field notes and observations may be viewed in *Appendix J*. A photographic log which includes photos of groundwater sampling may be viewed in *Appendix D*.

For the nine Callide Mine groundwater monitoring wells, a total of 26 sets of groundwater field parameters were collected between February 2022 and March 2023. In February 2023, field parameters were only measured for four samples. Groundwater parameters collected in the field may be viewed in *Table 3a* in *Appendix B*.

A summary of the field parameters for each monitoring well is presented below:

- 1904 (two samples) - pH ranged from 6.61 to 6.77, EC ranged from 2,390 μ S/cm to 2,302 μ S/cm, Temperature ranged from 23.9°C to 22.8°C, ORP ranged from 24.1mV to 89.5mV, DO ranged from 0.21mg/L to 0.7mg/L and TDS was calculated as ranging from 1,473mg/L to 1,530mg/L.
- DC01 (four samples) - pH ranged from 6.61 to 6.93, EC ranged from 5,031 μ S/cm to 7,504 μ S/cm, Temperature ranged from 20.5°C to 26.8°C, ORP ranged from -64mV to 0.9mV, DO ranged from 0.79mg/L to 1.3mg/L and TDS was calculated as ranging from 3,220mg/L to 4,803mg/L.
- DC02 (four samples) -- pH ranged from 6.39 to 6.71, EC ranged from 4,994 μ S/cm to 6,458 μ S/cm, Temperature ranged from 21.7°C to 29.2°C, ORP ranged from -137.1mV to -217.0mV, DO ranged from 0.6mg/L to 1.38mg/L and TDS was calculated as ranging from 3,196mg/L to 4,133mg/L.
- MB10 (four samples) -- pH ranged from 5.48 to 5.78, EC ranged from 1,832 μ S/cm to 2,396 μ S/cm, Temperature ranged from 24.2°C to 27.6°C, ORP ranged from 3.2mV to 94.0mV, DO ranged from 0.6mg/L to 2.0mg/L and TDS was calculated as ranging from 1,172mg/L to 1,533mg/L.
- MB12 (four samples) -- pH ranged from 5.70 to 6.26, EC ranged from 2,107 μ S/cm to 2,493 μ S/cm, Temperature ranged from 23.5°C to 31.7°C, ORP ranged from -95.4mV to -186.0mV, DO ranged from 0.7mg/L to 1.43mg/L and TDS was calculated as ranging from 1,348mg/L to 1,596mg/L.
- CM_MB15 (two samples) -- pH ranged from 4.48 to 4.82, EC ranged from 5,521 μ S/cm to 5,557 μ S/cm, Temperature ranged from 23.2°C to 26.8°C, ORP ranged from 55.0mV to 80.7mV, DO ranged from 2.35mg/L to 2.50mg/L and TDS was calculated as ranging from 3,533mg/L to 3,556mg/L.
- CM_MB17 – there was insufficient water to sample in both sampling rounds.
- CM_MB18 (two samples) -- pH ranged from 6.66 to 7.45, EC ranged from 2,292 μ S/cm to 2,870 μ S/cm, Temperature ranged from 20.5°C to 25.7°C, ORP ranged from 20.0mV to 30.7mV, DO ranged from 1.1mg/L to 1.26mg/L and TDS was calculated as ranging from 1,467mg/L to 1,837mg/L.
- CM_MB19 (two samples) -- pH ranged from 3.13 to 4.87, EC ranged from 2,210 μ S/cm to 2,417 μ S/cm, Temperature ranged from 24.5°C to 28.0°C, ORP ranged from 36.0mV to

244.5mV, DO ranged from 2.21mg/L to 2.30mg/L and TDS was calculated as ranging from 1,414mg/L to 1,547mg/L.

Beneficial Water may be sourced from one or many dams at the same time and may be moving from southeast to northwest or vice versa depending on both site and off-site requirements at any specific time. The quality of the BW therefore may be subject to some variation. Batchfire keep records of water pumping and these records were compared to the ERM sampling dates to ascertain where the source of the BW was likely to be on the dates that samples were collected.

Property reference numbers and BW off-takes may be viewed in Figure 4 in Appendix A. The BW02 off-take supplies a single landowner, shown as Property P01. Flow meter readings since August 2022 indicate that this landowner's annual BW use has been 0.34ML. The BW03 off-take supplies a single landowner shown as Property P02. Flow meter readings since August 2022 indicate that this landowner's annual BW use has been 60.78ML. The BW04 off-take supplies three landowners shown as Properties P04, P05 and P07. Flow meter readings since April 2019 indicate that one of these landowner's annual BW use has been 358.38ML. Flow meters have not been fitted for the other two properties. An un-numbered flow meter is fitted on the pipeline to another property, shown as Property P08, meter readings from March 2019 to October 2022 indicate an annual BW use of 26.33ML.

Another landowner receiving BW from off-takes between BW04 and BW05 is Property P09, which receives up to 20ML/year. Finally, the Banana Shire Council (Property P06) has an allocation of up to 5ML/year for dust suppression at the Trap Gully landfill, although it is understood that this allocation is usually met from surface water collection within the landfill site and BW has not been used, also supplied from an off-take between BW04 and BW05.

Only one sample was collected from BW02 in March 2023, with two samples collected from each of BW03, BW04 and BW05 in August 2022 and March 2023. In general, the BW water samples were clear to slightly turbid and had no odour. Water was being pumped from west to east (Ghost Ryders Dam to East Dam) on the 31/08/2022 and water was being pumped from east to west (East Dam to Ghost Ryders Dam) on the 29/03/2023.

The BW05 results are discussed in Section 4.2 below and in the Part B (Boundary Hill) DSI report. Properties connected to the BW05 supply are shown as Property P10 to Property P15.

4.2 BOUNDARY HILL

The MIA has a variety of surface materials present, however the soils across the site are mostly an alluvial sandy clay, existing from surface to 3-16 mBGL. Bare soil areas surrounding the workshop have been filled with a clay/gravel/rock mixture that has been compacted in place to support the movement of heavy vehicles. Some deeper hard rock was encountered which prevented further drilling in some sites, such as BH_MB04. The soils at the site originate from weathered sequences of the Biloela Formation, with harder rock at depth expected to be of the Biloela Formation.

The eastern edge of the workshop area has been cut into a hillside to level the ground for an access road, car parking and the workshop construction, the sub-surface layers are exposed. These were consistent with the subsurface layers encountered at BH_SB10 during delineation

sampling of the impact reported at BH_SB02. However, the delineation samples, BH_SB07 and BH_SB08 were within a compacted hardstand area used for parking heavy vehicles and storing parts and equipment, this surface limited hand auger penetration depth to 0.3m and 0.38m respectively due to refusal on rocks in the fill.

The concrete samples were obtained from outside Bay 3 (BH_CON_01) on the western side of the workshop and outside Bay 13 (BH_CON_02) on the east side of the workshop. No staining (other than tracked soil) was visible in the near area. The area was brushed off prior to coring to remove loose soil. Samples were obtained after coring by using an electric hammer drill fitted with a chisel, which was decontaminated before each use, pieces of upper and lower surface were discarded to avoid soil contamination of the sample.

Due to access to the workshops by mine haul trucks, the concrete aprons are quite thick and the cores were measured at 0.4m at CON01 and 0.4m at CON02. The concrete was in good condition despite the number of heavy vehicles that frequently traverse it. The concrete was also reinforced by steel rods and fine tensile wire strands throughout its thickness. This created difficulty in detaching sufficient small concrete chips for collecting the samples.

Photos of the concrete core sampling may be reviewed in *Appendix F*, with the locations of the samples shown in *Figure 4b*, *Appendix A*.

At the Boundary Hill site, the seven (BH_SED01 to BH_SED07) sediment sample locations were selected to target flow paths and expected receiving bodies. The sediment samples were collected at the following locations (shown in *Figure 4c*, *Appendix A*):

- BH-SED01 – this sample was taken from a drainage path leading from the western side of the Workshops towards Lake Gasteen. This location was selected in order to determine if runoff from the workshops was transporting PFAS from the workshop to the lake;
- BH-SED02 – this sample was taken from the northern end of Lake Gasteen between Sediment Dam 2 and the water in Lake Gasteen. When the lake is full, this location is submerged. This location was selected to target PFAS migration from Sediment Dam 2;
- BH-SED03 – this sample was taken from the base of the northern edge of Sediment Dam 2 where the drainage channel from the former FTA1 flows into Sediment Dam 2 to target PFAS migration from the former FTA1;
- BH-SED04 – this sample was taken from the surface at the Escape Tunnel outflow, an area known to have AFFF applied as part of rescue training events;
- BH_SED05 – this sample was taken from the outflow area of Lake Gasteen in the flow channel slightly west of RP3. This sample was collected to target potential impacts from outflow water from the lake;
- BH_SED06 – this sample was taken from the eastern bank of Lake Gasteen in the vicinity of the installed water pump. This sample targeted deposition from surface water flows from the western side of the workshops and southern end of the MIA into lake Gasteen; and,
- BH_SED07 – This sample was taken on the southern edge of Sediment Dam 2 near the outflow point of Sediment Dam 2, from which surface water flows into the northern end of Lake Gasteen.

Field observations of the surface water samples are listed in Table 3b in Appendix B, with summaries of surface water results presented in Section 3.7 above. Some surface water

samples were collected from pooled water in flow channels (BH_SW16, BH_SW12, BH_SW20) and were slightly to moderately turbid.

Surface water parameters collected in the field may be viewed in Table 3b in Appendix B. A summary of the results is below:

- pH ranged from 5.17 (BH_SW07) in Sediment Dam 2 to 9.0 (BH_SW06) in the Treatment Pond.
- EC ranged from 211 $\mu\text{S}/\text{cm}$ (BH_SW12) in Lake Gasteen to 3156 $\mu\text{S}/\text{cm}$ (BH_SW07) in Sediment Dam 2.
- Temperature ranged from 16.3°C (BH_SW04) Lake Gasteen to 36.8°C (BH_SW07) in Sediment Dam 2.
- ORP ranged from -17.3mV (BH_SW04) in Lake Gasteen to 208.9mV (BH_SW07) in Sediment Dam 2.
- DO ranged from 3.36mg/L (BH_SW04) in Lake Gasteen to 9.0mg/L (BH_SW06) in Treatment Pond.
- TDS was calculated as ranging from 135mg/L (BH_SW12) in Lake Gasteen to 2020 mg/L (BH_SW07) in Sediment Dam 2.

Field observations of the groundwater samples are listed in *Table 2 and 3a in Appendix B*, with summaries of groundwater results presented in *Section 3.6* above. Sediment was encountered in the Hydrasleeve bags at several bores. BH01, MB08, MB28, BH_MB02, BH_MB03 were all noted as having highly turbid water and silty sediment in the bottom of the bags. In the case of BH_MB03, the silt was observed to settle to the bottom of the bag over a period of twelve minutes.

Groundwater parameters collected in the field may be viewed in *Table 3a in Appendix B*. A summary of the results is below:

- pH ranged from 3.12 (BH_MB05) to 6.64 (BH_MB02).
- EC ranged from 9856 $\mu\text{S}/\text{cm}$ (BH_MB01) to 68200 $\mu\text{S}/\text{cm}$ (BH_MB02).
- Temperature ranged from 23.2°C (MB08) to 31.5°C (BH_MB05).
- ORP ranged from -18.5mV (MB08) to 336.4mV (MB28).
- DO ranged from 0.41mg/L (MB08) to 4.33mg/L (BH01).
- TDS was calculated as ranging from 6308mg/L (BH_MB05) to 43648 mg/L (BH_MB02).

The Beneficial Water sampled at the BW05 sample tap fitted to the Argoon Hill Tank is only sourced from Lake Gasteen. Surface water sampling of the lake has determined that this water exceeded the site criteria for both PFOS and PFOS plus PFHxS, including the drinking water criteria of 0.07 $\mu\text{g}/\text{L}$. Two water samples from the BW05 tap also exceeded these criteria:

- August 2022, PFOS concentration of 0.044 $\mu\text{g}/\text{L}$ exceeded the NEMP Freshwater high conservation value systems (99%) guideline value 0.00023 $\mu\text{g}/\text{L}$. The sum of PFHxS and PFOS 0.0829 $\mu\text{g}/\text{L}$ exceeds the NEMP drinking water guideline value 0.07 $\mu\text{g}/\text{L}$.
- March 2023, PFOS concentration of 0.0931 $\mu\text{g}/\text{L}$ exceeds the NEMP drinking water and exceeds the NEMP Freshwater high conservation value systems (99%) guideline values 0.07 $\mu\text{g}/\text{L}$ and 0.00023 $\mu\text{g}/\text{L}$. The sum of PFHxS and PFOS 0.158 $\mu\text{g}/\text{L}$ also exceeded the NEMP drinking water guideline value 0.07 $\mu\text{g}/\text{L}$.

The BW05 sampling tap is fixed to the side of a water tank (Argoon Hill Tank) to the south of the Boundary Hill MIA, on the eastern side of the entry road. Water is pumped from Lake Gasteen to fill this tank. The tank gravity feeds the properties located to the southwest of the tank, including a tank and trough on the Selmanovic property.

The BW05 off-take supplies multiple landowners, with the agreed BW guaranteed allocation for one landowner on Property P11 of up to 20ML/year. A single flow meter is fitted at the hill tank. Meter readings since August 2022 indicate that an annual volume of approximately 13.8ML has been supplied to the landowners (Properties P10-P15) connected to this tank, however individual properties are not metered. The meter volume indicates that very little of the available water supply from this tank (up to 100ML per year) is being taken up by the landowners. A new PFAS free water source for the hill tank has been connected by Batchfire.

BW was previously supplied to Property P11 via a pair of siphon pipes running over the Lake Gasteen dam wall, which until recently used to siphon water directly from Lake Gasteen to a dam on Gate Creek that flows to the dam on Property P11 on the Gate Creek flow path. Both these dams are un-named. A new pipeline is now in place and is proposed to be fitted with the BW01 sampling tap and currently has no flow meter. An alternate source of water is now supplying this new pipeline, this water is sourced from Boundary Hill pit inflows.

The BW05 sample location recorded total PFAS results at 0.19 µg/L and 0.348 µg/L for both samples, which was greater than any of the Southern Operations BW samples. The BW05 samples also have much higher proportions of PFOS and PFHxS with other PFAS, which is absent from the Southern Operations samples. This suggests that the BW05 water sourced from Lake Gasteen is impacted by PFAS releases of a type specific to the Boundary Hill site, which was not detected at other beneficial water sampling points.

5. QUALITY ASSESSMENT

The laboratories carried out their own quality assessment of the samples submitted. This includes duplicate samples, laboratory control samples, laboratory control spikes, method blanks, matrix spikes and the recovery percentage of surrogate compounds. The laboratories also reported on holding time outliers and quality control sample frequency outliers. Where samples required dilution, raised LOR's were noted. In some cases the samples had matrix interference effects or poor duplicate results due to sample heterogeneity effects and where this was noted it was confirmed by visual inspection.

The laboratories reported instances of duplicate outliers, laboratory control outliers, matrix spike outliers, holding time outliers and quality control sample frequency outliers. The laboratory reports including the QA and QC reports are included in the Appendices of the Part A and Part B DSI reports.

5.1 SOUTHERN OPERATIONS QA/QC ASSESSMENT

Field quality assurance procedures are detailed in the Callide Mine PFAS Work Plan (incorporating the Sampling and Analysis Quality Plan (SAQP)), which is appended in Appendix B. The Work Plans quality assurance and quality control (QA/QC) procedures were drafted with reference to the ASC NEPM (2013) and the PFAS NEMP (HEPA 2020) guidance for sampling.

This includes:

- Collection of replicate and secondary replicate samples at appropriate frequencies (1:10 primary samples) with the secondary replicate sample sent to a secondary NATA accredited laboratory for the same analysis as the primary sample;
- Replicate samples are not to be labelled in such a manner that the primary sample can be identified from the replicate sample ID;
- Use of laboratory supplied sample containers (HDPE) suitable for the collection of PFAS samples;
- Inserting laboratory trip blank samples into eskies to detect cross-contamination;
- Collection and preservation of samples as per the PFAS NEMP sampling guidance;
- Use of PFAS free cleaning solutions and a three-step cleaning process for reusable equipment;
- Collection of rinsate samples from reusable equipment (after cleaning) to verify cleaning procedures are effective,
- Transportation of samples to NATA accredited laboratories under Chain of Custody (COC) procedures, and
- Observing the PFAS sampling precautions for field staff carrying out PFAS investigations.

The above procedures are detailed in Section 6.1 of the Work Plan. QA/QC tables for replicate samples are included in Appendix C, Tables 9a – 9c and rinsate/trip blank samples are included in Table 10. Replicate samples are compared to their primary sample using the Relative Percent Difference (RPD) calculation to determine the acceptability of the result. The acceptable range of the RPD result is dependent on the difference between the sample result and the Estimated Quantitation Limit (EQL) of the analyte being tested. Where the result is between 1 and 10

times the EQL, the acceptable range is 0-50%. Where the result is greater than 10 times the EQL, the acceptable range is 0-30%.

RPD exceedances occurred for some soil, surface water, groundwater, concrete and sediment samples as detailed in the PSI report (Part A). Duplicate QA sample rates exceeded the required 1 per 10 primary samples guidance from the NEMP.

While some field QA replicate sample data exceeded the RPD limits, this was generally due to matrix interference and sample heterogeneity. The laboratory reports noted that matrix interference was responsible for adjusting the LOR for some analysis and that sample heterogeneity was confirmed by visual inspection.

Rinsate and trip blank samples collected during the PSI were analysed for a short suite of PFAS compounds using trace LOR, this analytical method was corrected to the full suite of 28 PFAS compounds and super ultra trace LOR prior to the DSI stages commencing. Only a single rinsate sample, W_RB05 dated 3/8/2022 had a result for an FTSA compound, 6:2 FTS, of 0.002µg/L (LOR 0.001µg/L). This analyte has no associated guideline value. No trip blanks recorded concentrations greater than the LOR, indicating that cross contamination during transport under COC conditions would not have occurred.

Overall, ERM's assessment of the QA/QC review of the Southern Operations sample data is that the data is suitable for reporting.

5.2 BOUNDARY HILL AQ/QC ASSESSEMENT

Field quality assurance procedures are detailed in the Boundary Hill PFAS Work Plan (incorporating the Sampling and Analysis Quality Plan (SAQP)), which is included in Appendix B. The Work Plans quality assurance and quality control (QA/QC) procedures were drafted with reference to the ASC NEPM (2013) and the PFAS NEMP (HEPA 2020) guidance for sampling.

This includes:

- Collection of replicate and secondary replicate samples at appropriate frequencies (1:10 primary samples) with the secondary replicate sample sent to a secondary NATA accredited laboratory for the same analysis as the primary sample;
- Replicate samples are not to be labelled in such a manner that the primary sample can be identified from the replicate sample ID;
- Use of laboratory supplied sample containers (HDPE) suitable for the collection of PFAS samples;
- Inserting laboratory trip blank samples into eskies to detect cross-contamination;
- Collection and preservation of samples as per the PFAS NEMP sampling guidance;
- Use of PFAS free cleaning solutions and a three-step cleaning process for reusable equipment;
- Collection of rinsate samples from reusable equipment (after cleaning) to verify cleaning procedures are effective,
- Transportation of samples to NATA accredited laboratories under Chain of Custody (COC) procedures, and
- Observing the PFAS sampling precautions for field staff carrying out PFAS investigations.

The above procedures are detailed in Section 7.1 of the Work Plan. QA/QC tables for replicate samples are included in Appendix C, Tables 9a – 9c and rinsate/trip blank samples are included in Table 10, Appendix B. Replicate samples are compared to their primary sample using the Relative Percent Difference (RPD) calculation to determine the acceptability of the result. The acceptable range of the RPD result is dependent on the difference between the sample result and the Estimated Quantitation Limit (EQL) of the analyte being tested. Where the result is between 1 and 10 times the EQL, the acceptable range is 0-50%. Where the result is greater than 10 times the EQL, the acceptable range is 0-30%.

RPD exceedances occurred for some soil, surface water, groundwater, concrete and sediment samples and are detailed in the DSI report (Part B). Duplicate QA sample rates exceeded the required 1 per 10 primary samples guidance from the NEMP.

While some field QA replicate sample data exceeded the RPD limits, this was generally due to matrix interference and sample heterogeneity. The laboratory reports noted that matrix interference was responsible for adjusting the LOR for some analysis and that sample heterogeneity was confirmed by visual inspection.

Rinsate and trip blank samples collected during the PSI were analysed for either a short suite of PFAS compounds using trace LOR (for Trip Blank samples, as indicated in Table 10, Appendix C), or the full suite of 28 PFAS compounds for Rinsate Samples. Out of the 26 QA samples in total, only two rinsate samples, W_RB01 and BH_RB01 recorded any results greater than the LOR. W_RB01 dated 28/07/2022 had a result for Perfluorooctane sulfonic acid (PFOS), of 0.0036 µg/L (LOR 0.0002 µg/L) and BH_RB01 dated 21/03/2023 had a result for Perfluorohexanoic acid (PFHxA) of 0.0006 µg/L (LOR 0.0005 µg/L). While the PFOS result exceeds the NEMP (2020) 99% Freshwater high conservation value systems criteria of 0.00023 µg/L, PFHxA has no associated guideline value. No trip blanks recorded concentrations greater than the LOR, indicating that cross contamination during transport under COC conditions would not have occurred.

Overall, ERM's assessment of the QA/QC review of the Boundary Hill sample data is that the data is suitable for reporting.

6. CONCEPTUAL SITE MODEL

A CSM is the qualitative description of plausible mechanisms by which human and/or environmental receptors may be exposed to site impact. For exposure to be considered possible, some mechanism (a 'pathway') must exist by which impact from a given source can reach a given receptor. This is termed a source-pathway-receptor (SPR) linkage. A CSM may be presented as a written (tabular) form, or a graphical (2D – 3D) form. For this report, the CSM is presented in written form accompanied by a 2D maps/plans of the potentially impacted locations, with a site cross section presenting graphically the SPR linkages as described in the text. A CSM was drafted for each site and updated following the collection of additional data in the DSI stage, these are discussed in Sections 6.1 and 6.2 below.

6.1 SOUTHERN OPERATIONS

The primary sources of PFAS within the Southern Operation site was likely to be associated with the historical storage and use of legacy fluorinated AFFF for fire training purposes at the former FTA, and historical storage and annual recharge of legacy fluorinated AFFF on mine vehicles at the warehouse and maintenance workshop (source areas). A change-out program carried out in 2019 has removed all legacy AFFF from use at the site. PFAS signature composition analysis shows that FTS compounds likely originate from the workshop area, as this is where the highest concentrations were noted in concrete and shallow soil samples (generally to 0.5m deep). FTS was not identified as a component of PFAS composition at the former FTA. The investigation results support the presence of PFAS across media assessed that could be associated with a mixture of AFFF including historical PFOS based AFFF and more recent FTS based AFFF. Actual firefighting incidents have been detailed in *Section 2.5.2* of the DSI Part A report. As some of these occurred at indistinct areas (such as the haul road), the reported locations are only approximate.

Other legacy fluorinated AFFF products used on-site include:

- 3M DC-3034 Light Water AFFF Fire Fighting Foam 6% Concentrate;
- Ansulite 6% AFFF ICAO-B; and
- Hydrofilm AFFF Premium 3% F-15 #4371.

The investigation results support the presence of PFAS across media assessed that could be associated with a mixture of AFFF including historical PFOS based AFFF and more recent FTS based AFFF.

Secondary sources of PFAS at the Southern Operations site were identified as soil, sediment, concrete, surface water and groundwater.

Soil samples from the compacted hardstand areas around the workshop and from the soil in the former FTA returned results for PFAS compounds in excess of the indirect exposure criteria and in one sample for the direct ecological exposure criteria and the public/open space criteria. Surface water runoff from the aprons may contain dissolved PFAS and sediment containing PFAS compounds. The former FTA has been resurfaced with virgin material from a clean source within the site and runoff is unlikely to be impacted, however infiltration to groundwater may occur due to the higher permeability of the uncompacted soils in this area.

Sediment was not found to be impacted by PFAS compounds at greater concentrations than guideline criteria adopted for this site. However, even where sediment has PFAS at less than the criteria, it has the potential to produce solute containing PFAS compounds under rainfall conditions that may exceed the water criteria.

Concrete was not found to be impacted by PFAS compounds at greater than the guideline criteria adopted for this site. However, leaching may occur that results in a solute containing PFAS compounds that may exceed the water criteria.

Surface water across the Southern Operations site was reported as having PFOS compounds exceeding the NEMP Freshwater (99%) criteria adopted for this site. Seven samples also exceeded the NEMP Freshwater (95%) criteria and eight samples exceeded the NEMP Drinking Water criteria with some samples exceeding the sum of PFHxS and PFOS criteria. The surface water PFAS signature composition indicates that the surface water impacts originate at the workshops area rather than the FTA.

Groundwater, PFOS exceeding the NEMP 99% and 95% freshwater ecological criteria and the NEMP drinking water criteria were reported on several occasions at monitoring bores MB10, MB12 and MB19 located near to the MIA. PFHxS and Sum of PFHxS and PFOS concentrations also exceeded the NEMP drinking water values for the majority of samples taken from these monitoring bores. Minor exceedances of some of the site criteria were recorded at various other monitoring bores across the site, MB15, 1904 DC01 and DC02 with some raised LOR's not ruling out potential exceedances of the 99% freshwater guideline value for PFOS. The results indicate that the PFAS contamination is restricted to the CCM aquifer and may have originated from infiltration of water from the drainage ditch that directs surface water runoff and wash bay water to the northern holding pond and/or from the more permeable former FTA soil. The CCM aquifer flow direction is to the north towards the Dunn Creek pit void. Groundwater in the aquifers underlying the CCM, the Muncon Volcanics and Youlambi Conglomerate, are hydraulically separated and not impacted by PFAS compounds.

Leaching tests carried out on soil, sediment and concrete indicate that these media are capable of producing a solute under laboratory conditions that may exceed the NEMP Freshwater 99% criteria for PFOS. While surface soils and sediment are readily contacted by rainfall events, the thickness of the concrete and nearby roofed workshop areas are expected to limit water infiltration and contact with the lower surface of the concrete. In-situ PFAS leaching from concrete may be significantly less than laboratory leaching test results indicate.

A graphical representation of the Southern Operations CSM is shown in Figure D below.

Source – pathway – receptor linkages were assessed for completeness (refer to Table 8.1 in the DSI Part A report).

Potentially Complete surface water pathways:

- Direct contact (dermal or ingestion) for on-site workers using the water for industrial purposes,
- Migration of PFAS impacted surface water between water bodies via drainage channels for on-site aquatic ecosystems, and
- Migration of PFAS impacted surface water between water bodies via drainage channels for off-site aquatic ecosystems.

Incomplete with management strategies surface water pathways:

- Direct contact (dermal or ingestion) for off-site users of the beneficial water reuse scheme.

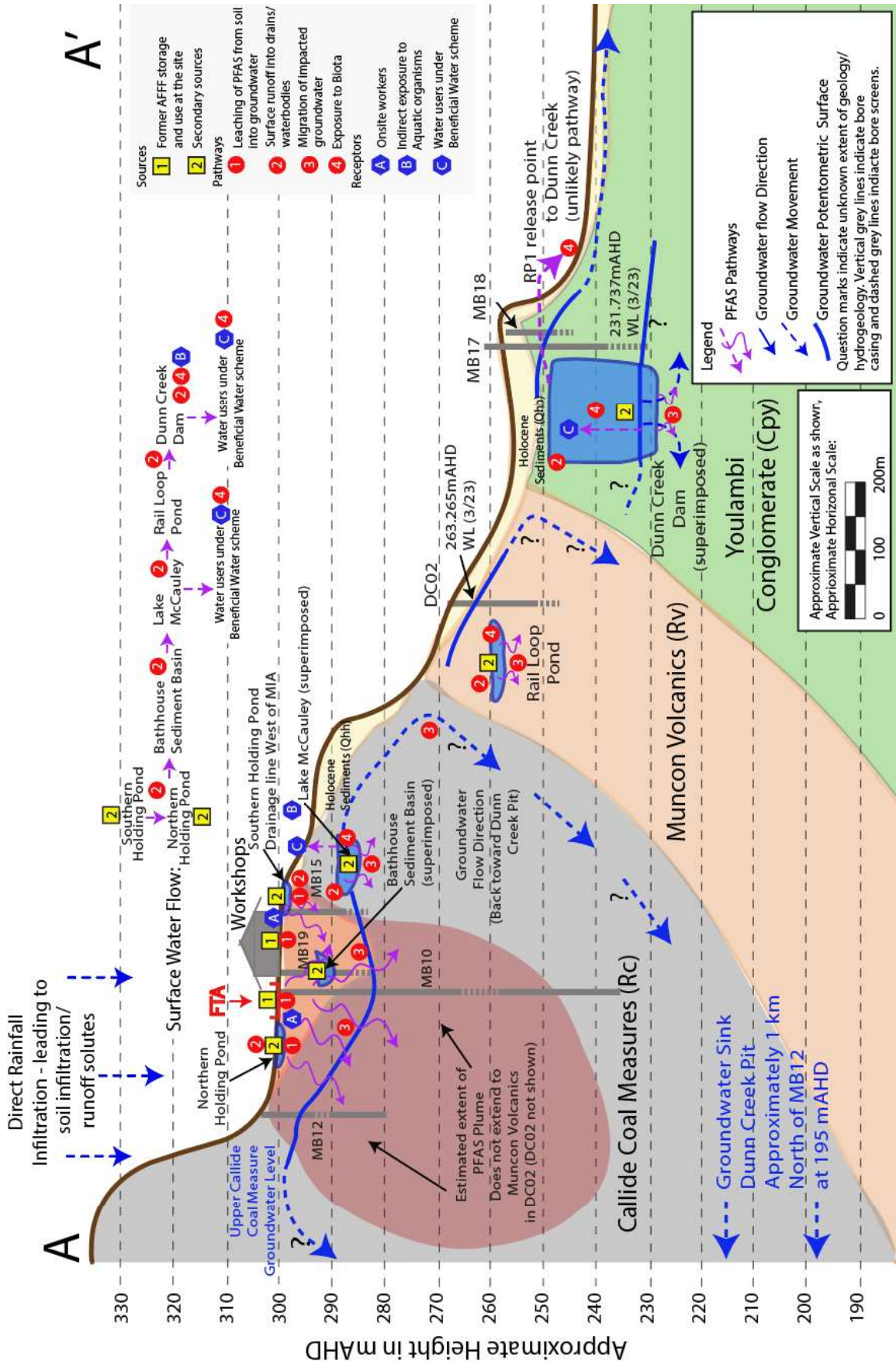


FIGURE D. CONCEPTUAL SITE MODEL OF THE SOUTHERN OPERATIONS AREA SURFACE AND GROUNDWATER FLOWS

6.2 BOUNDARY HILL

The primary on-site source is likely associated with historical storage and use of legacy fluorinated AFFF for fire training purposes at the former FTA1, and historical storage and annual recharge of legacy fluorinated AFFF on mine vehicles at the warehouse and maintenance workshop (source areas). A change-out program carried out in 2019 has removed all legacy AFFF from use at the site. As outlined in Section 2.5 of the DSI Part B report, the main legacy fluorinated AFFF product used on-site was Ansulite 6%. The type and composition of AFFF used on-site prior to 2009 is not documented but is suspected to be 3M Light Water, the known legacy fluorinated AFFF used on-site were:

- Aerowater Chubb 3% AFFF Fire Fighting Foam (containing Hydrocarbon surfactants 5-10% and Fluorosurfactants 5-10%);
- Ansulite 6% AFFF ICAO-B (contains no reported PFAS compounds);
- FireAde 2000 - Fire Fighting Agent (contains no reported PFAS compounds); and,
- FC-600F 3M Light Water ATC AR-3% OR 6% Fire Fighting Foam (containing Amphoteric fluoroalkylamine derivative 1-5%, Perfluoroalkyl sulfonate salts 1-5% and residual organic fluorochemicals (unknown %))

The investigation results support the presence of PFAS across media assessed that could be associated with a mixture of AFFF including historical PFOS based AFFF and more recent FTS based AFFF. PFAS signature composition analysis shows that FTS compounds likely originate from the workshop area (particularly just to the north-east of the workshop), as this is where the highest concentrations were noted in concrete and shallow soil samples (generally to 0.5m deep). FTS was not identified as a component of PFAS composition at the former FTA.

Secondary sources of PFAS at the Boundary Hill site were identified as soil, sediment, concrete, surface water and groundwater.

Soil exceeded the indirect ecological criteria for four samples at the former FTA and at three locations around the workshop aprons. The only direct ecological exposure soil exceedance was at the former FTA, which is considered a primary source zone with evidence of migration to groundwater from this source.

Sediment exceeded the PFAS NEMP criteria for indirect exposure at one sample location at Sediment Dam 2.

Concrete exceeded the PFAS NEMP criteria for indirect exposure in one of the four samples collected. However, leaching may also occur that results in a solute containing PFAS compounds that may exceed the water criteria. In-situ PFAS leaching from concrete may be significantly less than laboratory leaching test results indicate.

Surface water reported PFOS concentrations exceeding the PFAS NEMP Freshwater 99% criteria in all samples with the exception of BH_SW15 (collected from a water body just to the north of the coal loading area). Surface water samples also reported exceedances of the PFAS NEMP Freshwater 95% criteria and drinking water criteria, but there were no exceedances of the NEMP recreational water criteria. The PFAS composition in the surface water is a combination of PFAS compounds from all source zones within the site.

Groundwater is impacted beneath the former FTA1, with exceedances of the PFAS NEMP Freshwater 99%, 95% and drinking water criteria. The aquifer is within the Biloela Formation

and due to high salinity is unsuitable for any use, water from this aquifer is not extracted within the site and is unlikely to be extracted by off-site bores. The PFAS impact in groundwater has not been reported at nearby downgradient monitoring bores indicating a slow rate of groundwater movement within this aquifer limiting the impacted groundwater to the immediate vicinity of the former FTA1.

Leaching tests carried out on soil, sediment and concrete indicate that these media are capable of producing a solute under laboratory conditions that may exceed the NEMP Freshwater 99% criteria for PFOS. While surface soils and sediment are readily contacted by rainfall events, the thickness of the concrete and nearby roofed workshop areas are expected to limit water infiltration and contact with the lower surface of the concrete.

A graphical representation of the Boundary Hill CSM is shown in Figure E below.

Source – pathway – receptor linkages were assessed for completeness (refer to Table 8.1 in the DSI Part B report).

Potentially Complete surface water pathways:

- Direct contact (dermal or ingestion) for on-site workers using the water for industrial purposes, this pathway would be incomplete with safety protocols,
- Direct contact (dermal or ingestion) for off-site users of the beneficial water reuse scheme, and
- Migration of PFAS impacted surface water between water bodies via drainage channels for off-site aquatic ecosystems.

Unlikely to be complete pathways:

- Surface water, PFAS impacted soils entrained in surface run-off, migrating into nearby drainage channels or surface water bodies for on-site aquatic ecosystems,
- Surface water PFAS impacted soils entrained in surface run-off, migrating into nearby drainage channels or surface water bodies for off-site aquatic ecosystems,
- PFAS in sediments, direct contact (dermal or ingestion) for on-site terrestrial ecosystems (direct and indirect exposure),

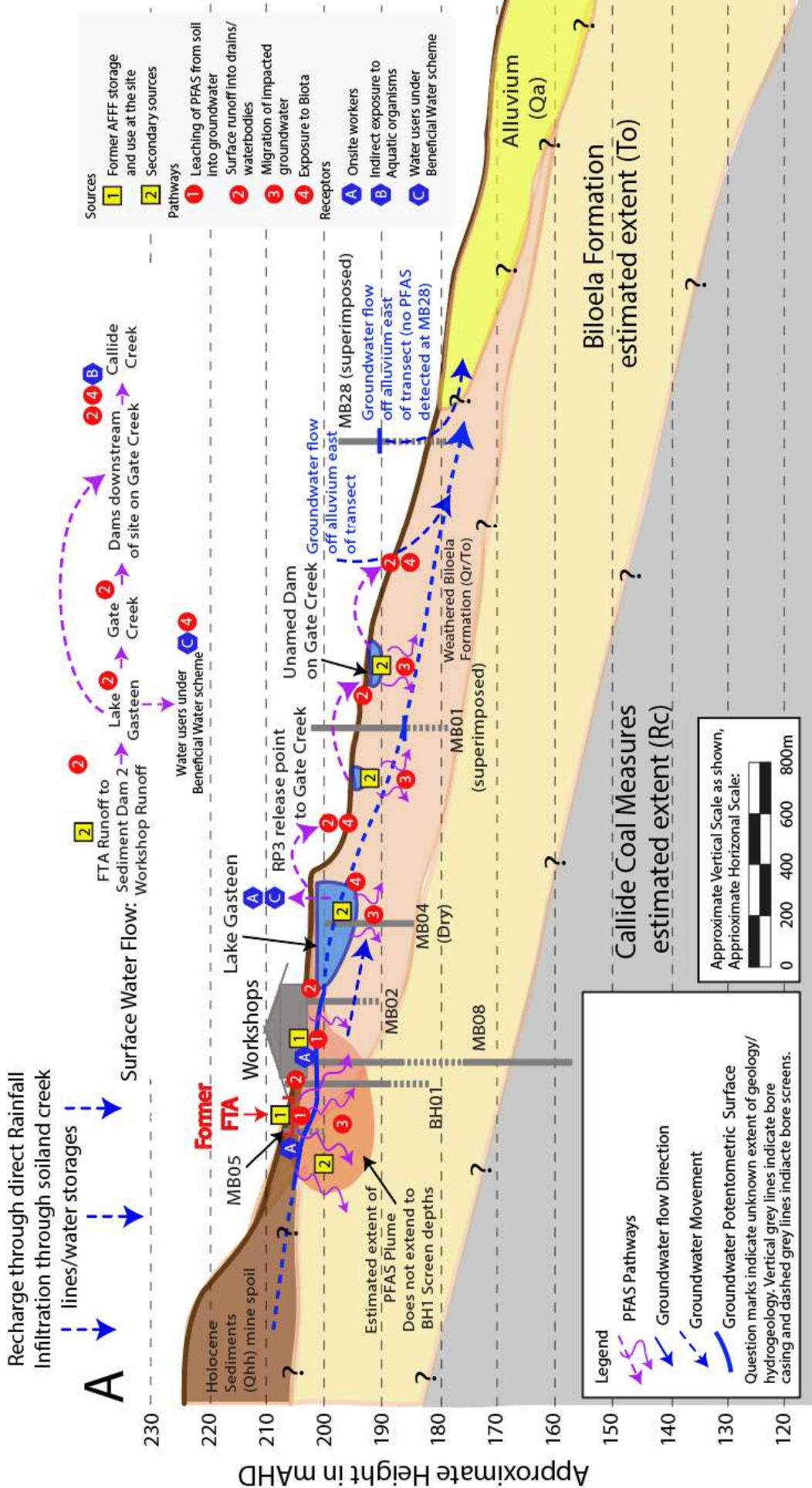


FIGURE E. CONCEPTUAL SITE MODEL OF THE BOUNDARY HILL SITE SURFACE AND GROUNDWATER FLOWS.

6.3 MIGRATION MECHANISMS

Migration of PFAS within the sites is primarily via rainfall runoff from PFAS impacted surfaces acting as primary and secondary sources. Soil, sediment and concrete impacted by PFAS has been found to leach under laboratory test conditions. PFAS that is dissolved by surface water flows is mobilised to the stormwater capture dams and then redistributed by pump transfer for reuse for industrial purposes at other locations within the mine site. Surface water runoff may also entrain PFAS impacted soil during heavy rainfall events and deposit this as sediment along flow paths and within dams and treatment ponds, noting that most flow paths are ephemeral at these sites. Discharges from designated storage dam release points within the mine sites has been prevented by Batchfire, however off-site use of mine water has previously occurred under a beneficial water use agreement.

6.4 KEY PFAS MIGRATION PATHWAYS

Migration pathways have been identified by the PSI and DSI reports, leading to the distribution of PFAS compounds within both the Southern Operations and Boundary Hill sites. In addition to pathways with each site, pathways to off-site receptors were also identified, both via natural ephemeral channels and via off-site supply of beneficial water for non-domestic uses under an agreement with local landowners. The migration pathways are discussed in detail for each site in Sections 6.4.1 and 6.4.2 below.

6.4.1 SOUTHERN OPERATIONS

The primary sources of PFAS at the Southern Operations area were identified as the workshop aprons, both concrete and compacted soil, and the soil of the former FTA. This has led to impacts in the surface water at major water storage dams within the site, cumulating at the Dunn Creek Dam and within groundwater in the CCM aquifer beneath the former FTA. While sediment results were all less than the criteria, sediment ponds at the Dunn Creek site and Trap Gully site contain impacted surface water.

The primary key pathway for the migration of PFAS within the site is surface water runoff during rainfall events. Where the runoff contacts PFAS impacted soil, concrete or sediment, leaching may occur that mobilises PFAS into the runoff stream and distributes the impacted water to water storage dams and sediment ponds. PFAS impacted water may also flow between water storage dams by ephemeral flow paths following the sites gradients, with the final receiving dam on the southern operations Dunn Creek site being the Dunn Creek Dam. Batchfire proactively manages the dam water storage levels to prevent water releases from the Dunn Creek dam.

The secondary key pathway to natural surface water flows is water pumped via a spine pipeline between major water storages within the site and used for industrial purposes within the site, which includes dust suppression on internal roads and vehicle washing. Some water is piped off-site from off-takes on the spine pipeline for non-domestic uses by local landowners under a beneficial use agreement with Batchfire. Non-domestic uses are mainly stock watering and crop irrigation.

Thirdly, some rainfall will infiltrate site soils and may leach PFAS through the soil profile to groundwater. While the aprons around the workshops are compacted clay/gravel and expected to have low permeability, the former FTA soils are lightly compacted soil and mine spoil

sourced from within the mine site workings. This soil is expected to have greater permeability and has high concentrations of PFAS, a substantial amount of PFAS remains in this soil, beneath the surface. The upper aquifer beneath the Southern Operations area is the Callide Coal Measures. This aquifer has been impacted in the vicinity of the former FTA. The sites CSM indicates that this aquifer has a low rate of transmissivity and flows to the north towards the Dunn Creek pit voids. There is no extraction of water from this aquifer within the site.

6.4.2 BOUNDARY HILL

The primary sources of PFAS at the Boundary Hill site were identified as the workshop aprons, both concrete and compacted soil, and the soil of the former FTA (FTA1). This has led to impacts in the surface water at the major water storage dam within the site (Lake Gasteen) and groundwater beneath the former FTA1.

The primary key pathway for the migration of PFAS within the site is surface water runoff during rainfall events. Where the runoff contacts PFAS impacted soil, concrete or sediment, leaching may occur that mobilises PFAS into the runoff stream and distributes the impacted water to water storage dams and sediment ponds. PFAS impacted water may also flow between sediment ponds by ephemeral flow paths following the sites gradients, with the final receiving dam on the Boundary Hill site being Lake Gasteen. Batchfire proactively manages the water storage at Lake Gasteen to prevent off site water releases.

The secondary key pathway to natural surface water flows is water pumped via a spine pipeline between major water storages within the site and used for industrial purposes within the site, which includes dust suppression on internal roads and vehicle washing. Lake Gasteen water has also previously been delivered off site via syphon pipes to unnamed water storage dams along the line of Gate Creek, below Lake Gasteen for non-domestic uses, the syphon pipes have now been replaced by a new pipeline connected to an alternative PFAS free water source. Lake Gasteen water was previously piped off-site to the Argoon Hill Tank for non-domestic uses by local landowners under a beneficial use agreement with Batchfire. An alternate PFAS free source of water has recently been connected to supply the Argoon Hill tank. Non-domestic uses are mainly stock watering and crop irrigation.

Thirdly, some rainfall will infiltrate site soils and may leach PFAS through the soil profile to groundwater. While the aprons around the workshops are compacted clay/gravel and expected to have low permeability, the former FTA soils are lightly compacted soil sourced from within the mine site workings built up over the natural site soils. This soil is expected to have greater permeability and has high concentrations of PFAS, a substantial quantity of PFAS remains in this soil. The upper aquifer beneath the Boundary Hill site is the Biloela Formation. This aquifer has been impacted in the vicinity of the former FTA1. The sites CSM indicates that this aquifer has a low rate of transmissivity and high salinity, making it unsuitable for any use, it flows to the south towards the Gate Creek flow path, but PFAS impacts are believed to be localised to the former FTA1 area. There is no extraction of water from this aquifer within the site.

7. ASSESSMENT OF PFAS DISTRIBUTION

PFAS distribution within the Batchfire mine sites is primarily at the MIA of each sites operating area. PFAS compounds released to ground either by maintenance activities or fire training activities are still present within the soil, concrete, sediment, some groundwater and surface water associated with those areas.

7.1 SOUTHERN OPERATIONS

The two identified source zones, the former FTA and workshops area have been proven to contain PFAS with two slightly different signatures (FTS observed at the workshops and is absent at the FTA). These source areas represent over 90% of the on-site residual PFAS mass. The soil contamination above guideline levels has been identified to depths generally to 0.5 m below ground level, but up to 3 m in some areas at the former FTA. These source areas have the potential to be a source of PFAS (particularly PFOS) in surface water. Further mass flux assessment of the source areas would allow for the assessment of the ratio of source strength to run-off, which would be helpful in determining where and to what depth additional soil source zone removal could be undertaken to achieve better environmental outcomes at the site. This work may include the drilling of additional soil bores across the site for further soil characterisation and undertaking surface water sampling, leachate tests on soil, either in-situ or via an external laboratory.

7.2 BOUNDARY HILL

The two identified source zones, the former FTA1 and workshops area have been proven to contain PFAS with two slightly different signatures (FTS observed at the workshops but is absent at the FTA). The soil contamination above guideline levels has been identified to depths generally to 0.5 m below ground level in the workshops area, but up to 2 m below ground level at the former FTA1. The bulk of the PFAS mass (88.1%) is calculated to be contained within soils at the former FTA1 (65.4%) and the northern apron (22.7%). As any soil containing PFAS compounds may leach PFAS containing solute following water infiltration, the remediation of the former FTA1 source zone is being considered by Batchfire in 2024. If the remediation of residual soil contamination is undertaken, this work will include the drilling of additional soil bores across the area of concern for further soil characterisation and undertaking leachate tests on soil, either in-situ or via an external laboratory.

8. IDENTIFIED DATA GAPS IN THE DSI REPORTS

Due to the change of ownership of the site in 2017, a full history of PFAS use and release incidents was not available. Changes to the site roads and stockpile areas make it impossible to determine exactly where reported incidents took place, for areas outside the MIA of each site, limited investigations were able to be undertaken. Due to the size of the land parcels involved, sampling density guidance was not practicable, with sampling focused on known PFAS handling areas and minimal sampling outside these areas. PFAS impacted soils have not been fully delineated at some locations of each site, mainly due to site use restrictions and site boundaries, no off-site sampling is included in these reports, however a Human Health and Environmental Risk Assessment (HHERA) that includes biota sampling may be triggered for that purpose. Locations with the potential for PFAS impacts to go off-site have been also identified by the DSI, but were not able to be quantified, as access for collecting samples from the neighbouring land was not granted at the time of the site investigations being carried out.

Water storage dams within both sites are artificial impoundments, often constructed by the valley fill method, whereby a natural valley has an earthen wall constructed across the down gradient end trapping surface water runoff. As such, water storages within the sites are considered to have low environmental values. The water storages are either within or on the edge of heavy mining works and no access by the workforce or the public is allowed for recreational activities. Stored water is used for industrial uses within the sites and dam levels are varied across the year as required for the operation of the sites. Biota assessments were not carried out for on-site water storage dams.

These data gaps are discussed in the following sections 8.1 and 8.2 below.

8.1 SOUTHERN OPERATIONS

An ephemeral flow path exists to the southwest of the workshops running from north to south. While this is a natural feature, it has been subject to some remediation and rehabilitation at the northern end and is rock lined to minimise scour erosion. A concrete weir exists at the southern end of the flow path, approx. 10m north of the site boundary. Surface water samples (CM_SW13, CM_SW16 and CM_SW26) and sediment samples (CM_SED01, CM_SED04 and CM_WEIR) have been obtained in the vicinity of this structure. All surface water samples have results exceeding the relevant guidelines. All sediment samples have soil results within the relevant guidelines, CM_SED01 was also tested for TOP Assy and the result was within the guideline. However, the CM_WEIR sediment sample was subjected to ASLP testing and exceeded the Freshwater 99% criteria. Surface water runoff during heavy rainfall events may leave the site via this pathway. No samples were able to be collected to the south (down gradient) of this location due to not having access to areas beyond the site boundary. The source of these exceedances has not been determined.

A second ephemeral flow path exists to the southeast of the workshop leading to the southern boundary of the site. Surface water runoff from the southern apron of the workshop and from the concrete surfaced yard of the warehouse has previously flowed into this flow path during heavy rainfall events. No surface water was present at the time of sampling, soil samples were collected by hand auger at near surface and depth at just north of the site boundary. The upper soil sample, CM_HA12 (0.1-0.2m) exceeded the NEMP PFOS site criteria for indirect

ecological exposure. A deeper sample (0.5-0.6m) delineated the impact to the upper soil strata. No samples were able to be collected to the south (down gradient) of this location due to not having access to areas beyond the site boundary.

To the north of the workshop, soil samples collected at CM_SB02 (0.25-0.35m) exceeded the NEMP PFOS criteria for ecological indirect exposure. The sample was also subjected to ASLP and found to exceed the site criteria for PFHxS, PFOS and the sum of PFHxS and PFOS. This impact was not vertically delineated. All surface water runoff from this area reports to the northern holding pond. Samples collected to the north (CM_HA03) and west (CM_HA08) delineated the lateral impact; however, no samples were able to be collected to the west of CM_SB02 due to the presence of a compacted heavy vehicle road and heavy vehicle parking area, both in constant use.

A sample collected at the western end of the workshop, CM_SB07 exceeded the ecological indirect exposure site criteria for PFOS at both 0.25-0.35m and 0.5-0.6m but did not exceed at 3-3.1m depth and so is delineated vertically. CM_HA04 (0.05-0.15m) collected to the west of CM_SB07 also marginally exceeded the NEMP ecological indirect exposure site criteria for PFOS, vertical delineation was not able to be achieved due to refusal of the auger on the compacted hardstand material. To the west of this location were more compacted hardstand laydown areas and site heavy vehicle roads and the impact was not delineated to the west. Surface water runoff from the western end of the workshop is expected to flow to the southern holding pond.

All surface water storages within the site are artificially created. Two surface water holding ponds are present, one to the north of the workshop and the second to the south of the workshop. The southern holding pond is not connected to the remainder of the surface water flow path network, which commences with the northern holding pond. Surface water runoff from the northern workshop apron, vehicle wash bays, various storage sheds and the light and heavy vehicle refuelling areas is directed to this pond. Overflow from the northern holding pond flows to Lake McCauley via the Bathhouse Sediment Basin. Lake McCauley and the Rail Loop Pond overflow to the Dunn Creek Dam, while two other dams, the Magazine Dam and the East Dam also overflow to the Dunn Creek Dam. The water is used for industrial purposes and water levels in the dams are varied to suit operational needs, de-silting activities take place as required. While surface water was sampled, no biota sampling was carried out for these water storages.

8.2 BOUNDARY HILL

Former FTA1 area was investigated via two test pits (BH_FTA01 and BH_FTA02) and one soil bore (BH_MB05) located between the two test pit locations that was converted to a groundwater monitoring well. Of the two test pits, only BH_FTA01 on the western side exceeded the NEMP PFOS ecological indirect exposure site criteria at both depths, 0.5-0.6m and 1-1.1m. BH_MB05 exceeded the NEMP PFOS ecological indirect exposure criteria at 0.25-0.35m and 0.5-0.6m, but not at 2-2.1m, delineating the impact vertically. To the south, there is a bund wall and a drop off to Sediment Pond 2. A sample, BH_SED03 was collected from within the northern edge of the sediment pond which marginally exceeded the NEPM PFOS ecological indirect exposure site criteria. The FTA1 impact has not been delineated to the north (a distance of approx. 30m to the coal conveyor belt) to the south or to the west of the FTA1 area.

One surface water sample, BH_SW16 to the north of the MIA on an ephemeral flow path exceeded the NEMP Freshwater high conservation systems (99%) site criteria. The source of this impact was not found due to dry conditions during subsequent site visits. The site history does not indicate any potential PFAS release upgradient of this location and the source is undetermined.

A sample collected on the southern edge of the MIA admin building returned results greater than the NEMP PFOS ecological indirect exposure criteria at the BH_SB05 (0.5-0.6m) location and was not vertically delineated due to refusal of the hand auger on rocks. Additional samples were collected to delineate the initial sample, however BH_SB09 (0.4m) to the east also exceeded the NEMP ecological indirect exposure site criteria and was not vertically delineated due to auger refusal on rocks. Of note, both BH_SB05 and BH_SB09 had upper samples that were not PFAS impacted. Samples collected from BH_SB10 to the south did not exceed any site criteria and therefore delineates the impact to the south. To the north is an administration building and to the west an asphalt sealed car park. The site history does not indicate any PFAS release within this area of the site and the source of this impact is undetermined.

All surface water storages within the site are artificially created. There is one main water storage within the site, Lake Gasteen. A small pond just to the north of the coal loading apron overflows to Lake Gasteen and all other areas of the site drain to Lake Gasteen via either one of the three sediment ponds or the treatment ponds located at the northern end of the maintenance area. Water is pumped from Lake Gasteen for industrial use within the site, in the past this water was also supplied for off-site use but this source has been discontinued for off-site use. Two dams exist down gradient of Lake Gasteen on the flow path of Gate Creek, with the furthest of these extending off the mine lease to the south. The Gate Creek dams are used to hold water for irrigation purposes. While surface water was sampled, no biota sampling was carried out for these water storages.

9. RISK MANAGEMENT AND MITIGATION MEASURES

Batchfire employs a number of management strategies for the control of the mine sites that also mitigate against the potential impact of PFAS, both on-site and off-site.

9.1 SOUTHERN OPERATIONS

Management of dam water levels – Batchfire proactively manages the dam water storages to prevent off-site water releases. Dam water is used within the site and can be pumped between water storages and use locations via the spine pipeline. The final receiving dam, the Dunn Creek dam has its water level lowered each year in preparation for the wet season to prevent water releases. A water release from the Dunn Creek dam via the Environmental Authority release point, RP1, has not occurred since March 2017.

Capping of former FTA – after ceasing fire training operations, Batchfire carried out a surface scrape and removal of impacted material at the former FTA. The surface was then capped with approx. 0.3m of clean material from a virgin source (The Bluff) within the site. While deeper PFAS impact remains in the soil at this location, any surface rainfall runoff and sediment should not contain PFAS. Infiltration of PFAS to groundwater has been verified as only impacting the upper Callide Coal Measures aquifer, which flows to the north toward the Dunn Creek pits and not off-site. No water is extracted from this aquifer for any use and the aquifer is not hydraulically connected to the two deeper aquifers beneath the site.

Sediment removal from the Southern Holding Pond – following PSI results that indicated that the Southern Holding Pond was highly impacted with PFAS, Batchfire carried out sediment removal from this holding pond. The sediment was removed to an off-site facility under a disposal permit. PFAS concentrations in both the sediment and surface water in the Southern Holding Pond subsequently declined considerably following this action, which was verified by two DSI sampling rounds.

Redirecting surface water flows to the Southern Holding Pond – on the edge of the southern workshop apron a flow path had been established that allowed surface water runoff to discharge into the southeast flow channel and subsequently off-site. This flow path has been closed off and the southern apron surface water runoff now reports to the Southern Holding Pond. Diverting the surface water at this location is expected to mitigate against the potential for PFAS to enter the off-site flows from the southeast flow path.

Redirecting water in the southern holding pond – the Southern Holding Pond was constructed as an evaporation loss pond with no outflow drainage system. This may be the reason why the PFAS concentrations have been higher in this pond than any other water body within the site. Batchfire are currently in the design process to have this pond connected to the channel leading to the Northern Holding Pond, which is in turn connected to the sites water treatment and water storage dams. Converting the Southern Holding Pond pond from evaporation loss to flow through, after these works above are completed, is expected to reduce the concentrations of PFAS compounds in the sediment and surface water.

9.2 BOUNDARY HILL

Alternative source of beneficial water for syphon pipes – two syphon pipes that were originally used to transfer the water from Lake Gasteen to the irrigation dams further down Gate Creek have been replaced by a new pipeline connected to a PFAS free source of water from the mine pits. This mitigates against supplying PFAS impacted water to the off-site user of this water under the beneficial water use agreement.

Sourcing of alternative supply of beneficial water for Argoon Hill Tank – this water was previously pumped from the Lake Gasteen storage dam, however Batchfire have now connected an alternative source of water to supply the hill tank and the off-site users that receive water from this supply under the beneficial water use agreement. Sampling will be used to confirm the reduction/removal of PFAS compounds in this water by collecting samples at the hill tank sample tap.

Proposal for the remediation of soils in the former FTA1 area – Batchfire have sought a proposal for the remediation (removal and or treatment) of PFAS impacted soil located at the FTA1 area. The objective of this remedial work is to remove a potential source of PFAS that may be adversely impacting the surface water stored within Lake Gasteen. This will mitigate against the risk of using this water supply in the future should the PFAS concentrations be reduced sufficiently by this scope of works.

10. CONCLUSIONS

The scope of works followed by ERM are consistent with that required by the EEN and attempt to follow the EP Act (1994) s389 and s390 with regards to the content requirements of a CLID. However, in some respects, the relevant sections of the EP Act were not able to be followed. The PSI and DSI are focused on a single contaminant, PFAS, that may have been released within the Callide mine sites. The Contaminated Land Auditor has provided review comments but not an audit report as the full intent of the Act with regards to the submission of a CLID cannot be fulfilled.

The site investigation works were carried out in stages. A robust CSM was developed and refined as the investigations progressed. For ease of understanding, the Southern Operations (consisting of three areas, Dunn Creek, the Hut and Trap Gully) were reported in a Part A report, while the Boundary Hill mining area was covered in the Part B report. The reports include the Work Plans and Sampling and Analysis Quality Plans for the site investigations.

Some data gaps remain despite several rounds of site sampling and are detailed in Section 8 above. Risk management and mitigation measures have also been implemented at both sites as detailed in Section 9 above. Examples of this such as the Boundary Hill FTA1 area to be subjected to additional sampling for the delineation of the PFAS impact with the aim of undertaking soil remediation/treatment where practicable. PFAS free water sources have been substituted for impacted sources at the Boundary Hill site where the water is sent off site for other uses under the beneficial water use agreement with local landowners. Off-site sampling, including biota assessment will be included under a HHERA.

11. REFERENCES

Additional reference sources relevant to the investigation:

- Australian Government National Health and Medical Research Council (NHMRC) (2019) 'Guidance on Per and Polyfluoroalkyl Substances (PFAS) in Recreational Water';
- *Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2023* (ANZG) (2018) 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality';
- Batchfire (no date) Firefighting Foam – Site Audit Foam;
- Batchfire (2019a) Disposal Plan – Aqueous Film Forming Foam (AFFF) (June 2019);
- Batchfire (2019b) Documents associated with the upgrade of the firefighting system to fluorine free including:
 - Wormald Cost Breakdown – April to June 2019;
 - Minor Services Agreement between Batchfire and Wormald Australia P
 - Batchfire Contractor Meeting Agenda and Minutes (7 August 2019);
 - Batchfire Contractor Meeting Agenda and Minutes (19 August 2019);
 - Batchfire Contractor Meeting Agenda and Minutes (11 November 2019);
- Batchfire (2021a) AFFF Use and Service Maps;
- Batchfire (2021b) Groundwater Level Database (GWLD), as provided to ERM March 2021
- Batchfire (2021c) SHMS HMP07 – Prohibited Items and Substances (as updated 4 March 2021);
- DES (2020) 'Queensland Ambient PFAS Monitoring Program 2019-2020'
- DES (2019) 'Environmental Protection (Water and Wetland Biodiversity) Policy'';
- DES (2011) 'Water Quality Objectives – Basin No. 130 (part), including all waters of Callide Creek Catchment within the Dawson River Sub-basin';
- Department of Health (DoH) (2019) Health based guidance values for PFAS for use in site investigations in Australia, Australian Government, Canberra;
- Department of Natural Resources and Mines (2015) Biloela Compilation Plot, Geology Map, Sheet 9049.
- GHD (2013) Callide Mine Water Management Study Trap Gully Dewatering Strategy
- Golder & Associates (2014) Summary of EA Borehole Drilling
- Golder & Associates (2016) Summary of Groundwater Bore Drilling at DC01 and HUT01
- Hansen Bailey (2018) Callide Mine Water Management Plan
- Hansen Bailey (2019) Callide Mine Erosion and Sediment Control Plan
- NHMRC, NRMCC (2011) Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra. Version 3.7 updated January 2022.
- NRMCC (2019) Guidance on Per and Polyfluoroalkyl (PFAS) in Recreational Water, Canberra;
- State of Queensland (Department of Natural Resources, Mines and Energy) (2020) Biloela Sheet 9049-3 50k Topographic Map

- Queensland Government QImagery Aerial Photographs 1958 – 2017
<https://qimagery.information.qld.gov.au/> (accessed on 24 June 2021)
- ERM (2022) Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland. Callide Mine Site Per – and Poly-Fluoralkyl Substances Preliminary Site Investigation (2021-2022) 28 April 2022
- ERM (2022) Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland. Boundary Hill Site Per – and Poly-Fluoralkyl Substances Preliminary Site Investigation (2021-2022) 28 April 2022
- ERM (2024) Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland. Callide Mine Site Per – and Poly-Fluoralkyl Substances Detailed Site Investigation (2022-2023) Part A (Southern Operations) 5 March 2024
- ERM (2024) Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland. Boundary Hill Site Per – and Poly-Fluoralkyl Substances Detailed Site Investigation (2022-2023) (Boundary Hill Site) Part B 15 March 2024

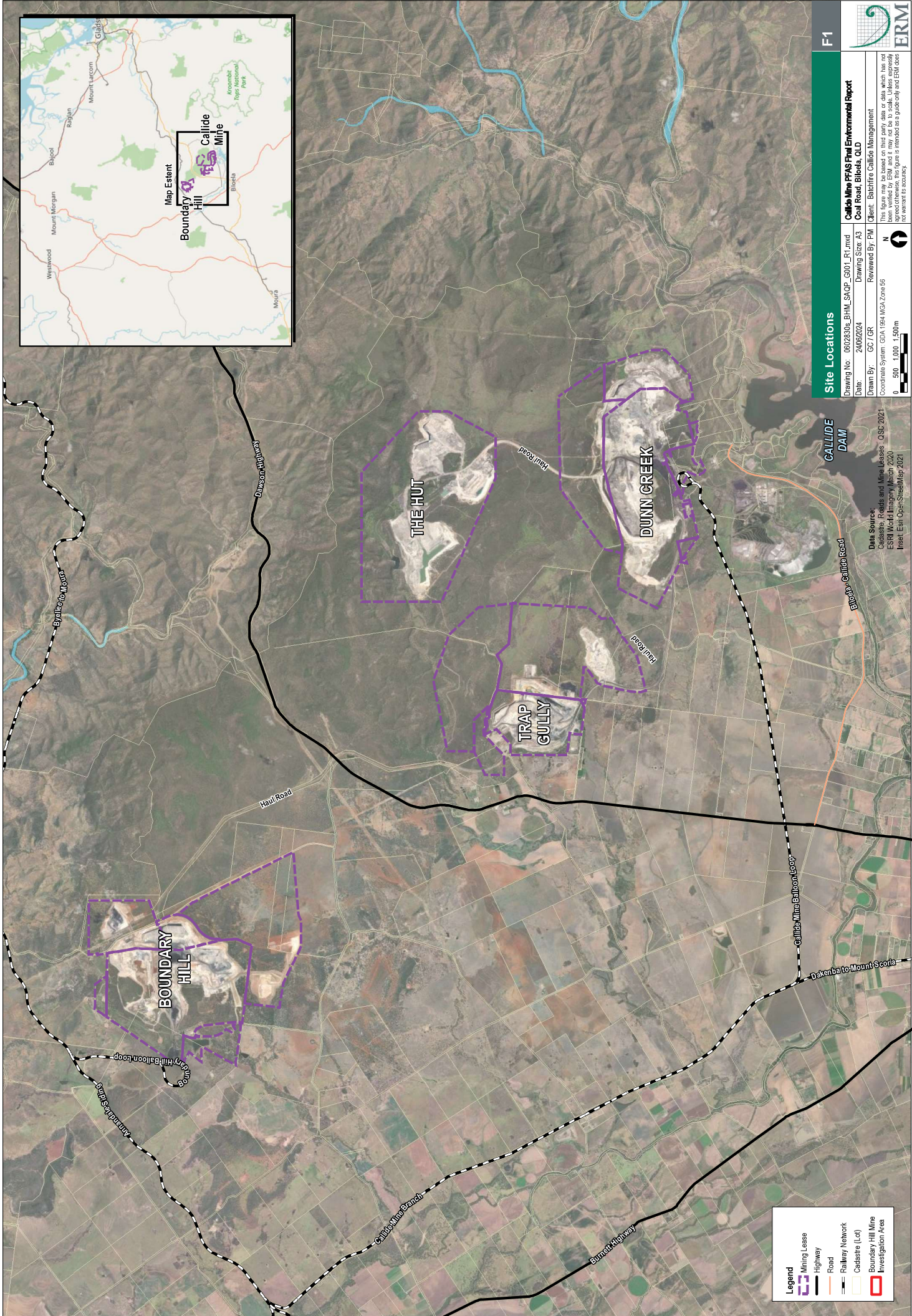
12. STATEMENT OF LIMITATIONS

1. This report is based solely on the scope of work described in Section 1.5 (Statement of Works) and performed by ERM Australia Pacific Pty Ltd (ERM) for Batchfire Callide Management Pty Ltd (Batchfire) (the Client). This report is being prepared for the Queensland Government in response to the EEN issued to Batchfire. The Scope of Work was governed by a contract between ERM and the Client (Contract).
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between 14 July 2021 and 26 June 2024 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.
5. Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.
6. This report is based on one or more site inspections conducted by ERM personnel, the sampling and analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:
 - did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
 - assumes no responsibility or liability for errors in data obtained from,
 the Client, any third parties or external sources (including regulatory agencies).
7. Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.
8. Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:
 - the suitability of the site(s) for any purpose or the permissibility of any use;
 - the presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
 - the presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).

9. Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.
10. The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.
11. This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.
12. Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:
 - has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
 - does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
 - does not purport to provide, nor should be construed as, legal advice.



APPENDIX A FIGURES



Site Locations

Drawing No: 0802830g_BHM_SACP_G001_R1.mxd
 Date: 24/06/2024
 Drawn By: GC / GR
 Reviewed By: PM

Client: Battifore Callide Management
 Coal Road, Bilola, QLD
 Callide Mine FFAS Final Environmental Report

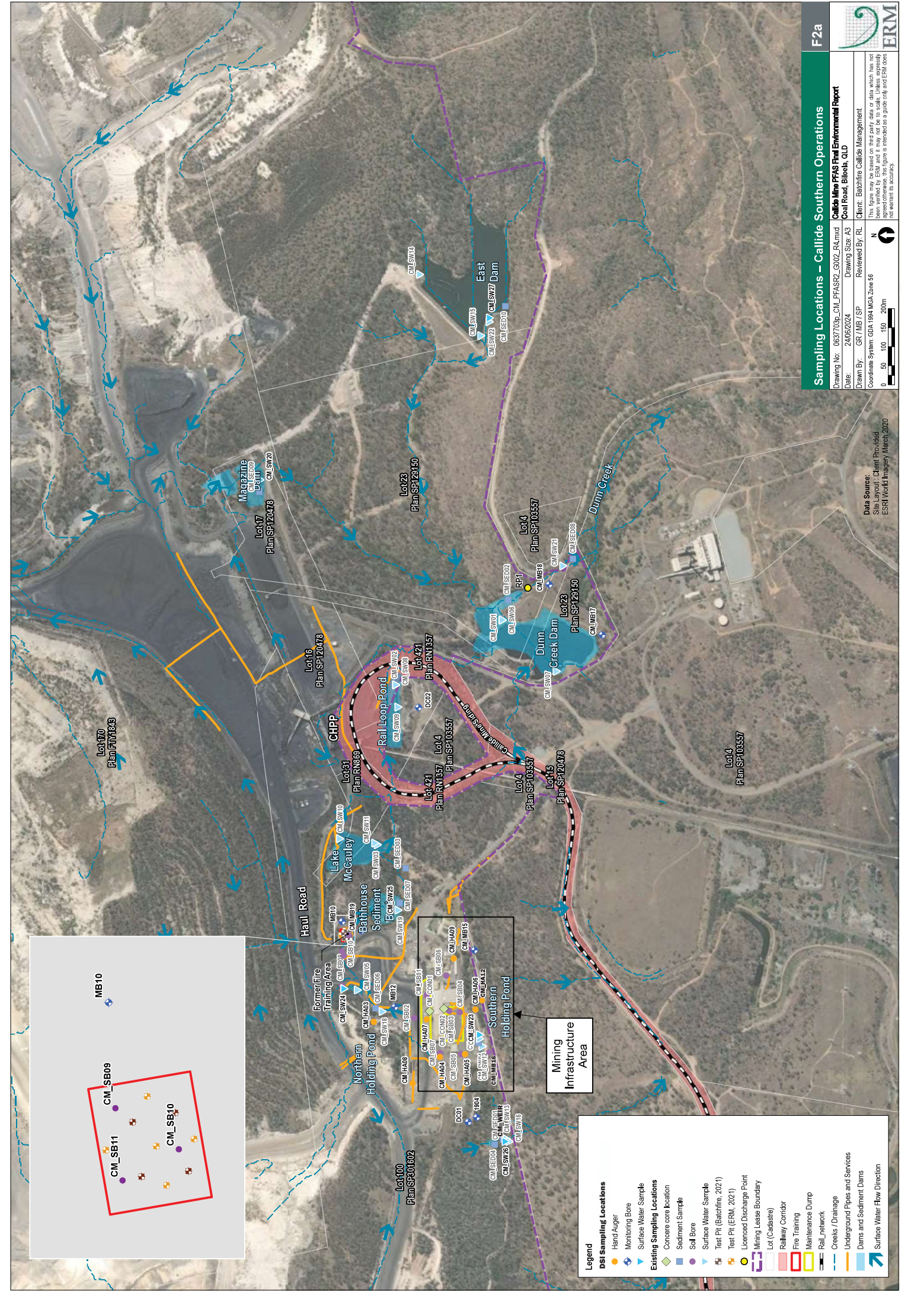
F1

ERM

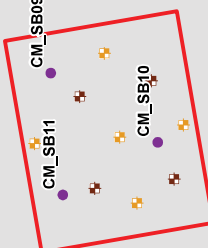
Data Sources:
 Callide Roads and Mine Leases: OSC 2021
 ESRI World Imagery: March 2021
 Inert: Esri OpenStreetMap 2021

Coordinate System: GDA 1984 MGA Zone 55
 North Arrow: N
 Scale: 0 500 1,000 1,500m

- Legend**
- Mining Lease
 - Highway
 - Road
 - Railway Network
 - Cadastre (Lot)
 - Boundary Hill Mine
 - Investigation Area



Data Source:
Site Data: Client Provided
ESRI World Imagery March 2020



- Legend**
- DSI Sampling Locations**

Hand Auger

Monitoring Bore

Surface Water Sample

Existing Sampling Locations

Sediment Sample

Soil Bore

Surface Water Sample

Test Pit (Batchline, 2021)

Test Pit (ERM, 2021)

Licensed Discharge Point

Mining Lease Boundary

Lot (Cadastral)

Railway Corridor

Fire Training

Maintenance Dump

Rail network

Creeks / Drainage

Underground Pipes and Services

Dams and Sediment Dams

Surface Water Flow Direction



Legend

DSI Sampling Locations

- Surface Water Sample
- Licensed Discharge Point

Existing Sampling Locations

- Sediment Sample
- Surface Water Sample
- Creeks / Drainage
- Dams and Sediment Dams
- Mining Lease Boundary
- Lot (Cadastral)
- Surface Water Flow Direction

F2b

Sampling Locations – Trap Gully

Drawing No: 09377039_TG_PFASR2_G003_R4.mxd

Date: 24/03/2024

Drawn By: GRT/MB/SP

Reviewed By: PM

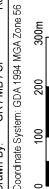
Client: Batchfire Calide Management

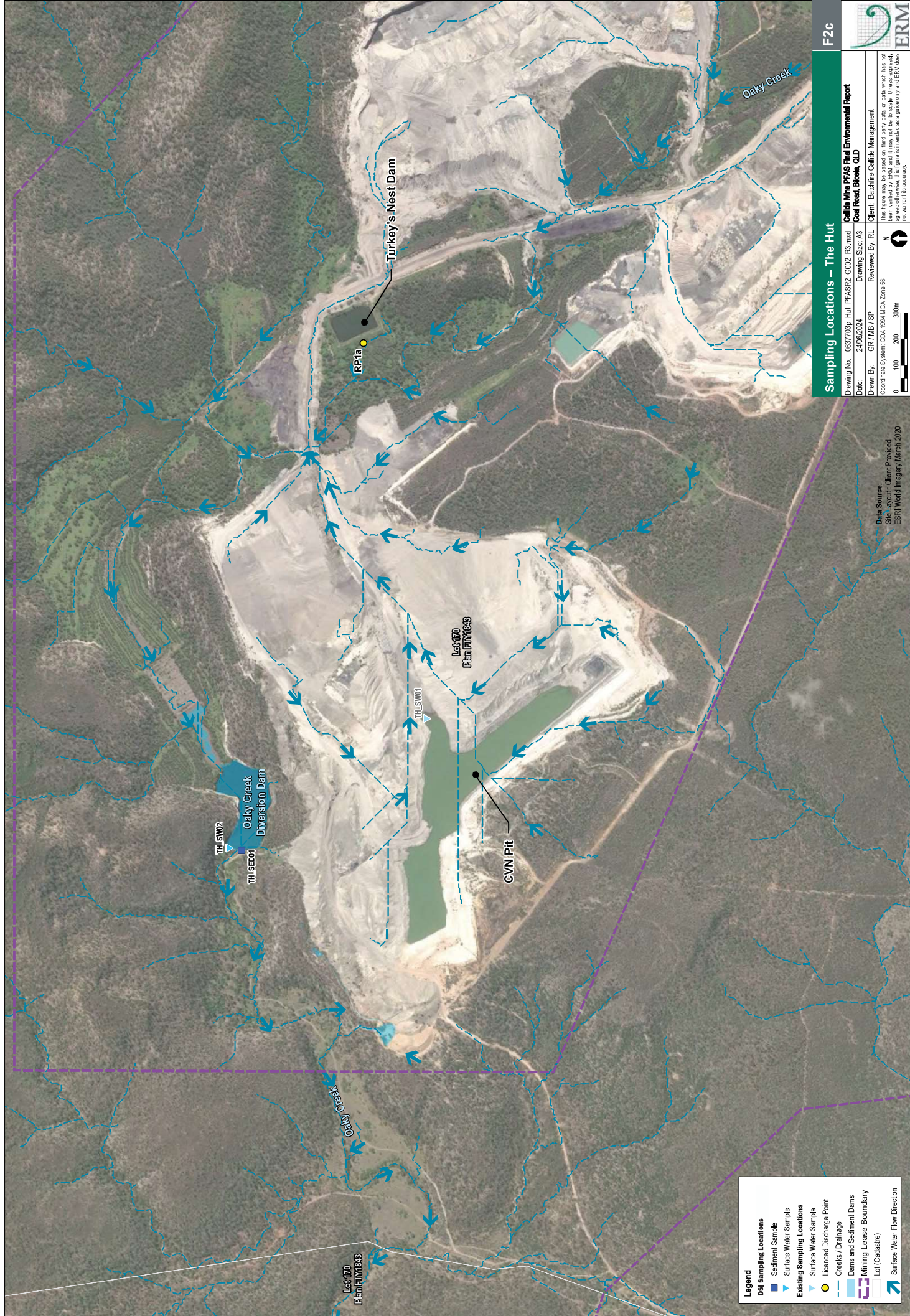
Calide Mine PFAS Final Environmental Report

Cool Road, Biloela, QLD

This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Data Source:
Site Layout: Client Provided
ESRI World Imagery March 2020





F2c

Sampling Locations – The Hut



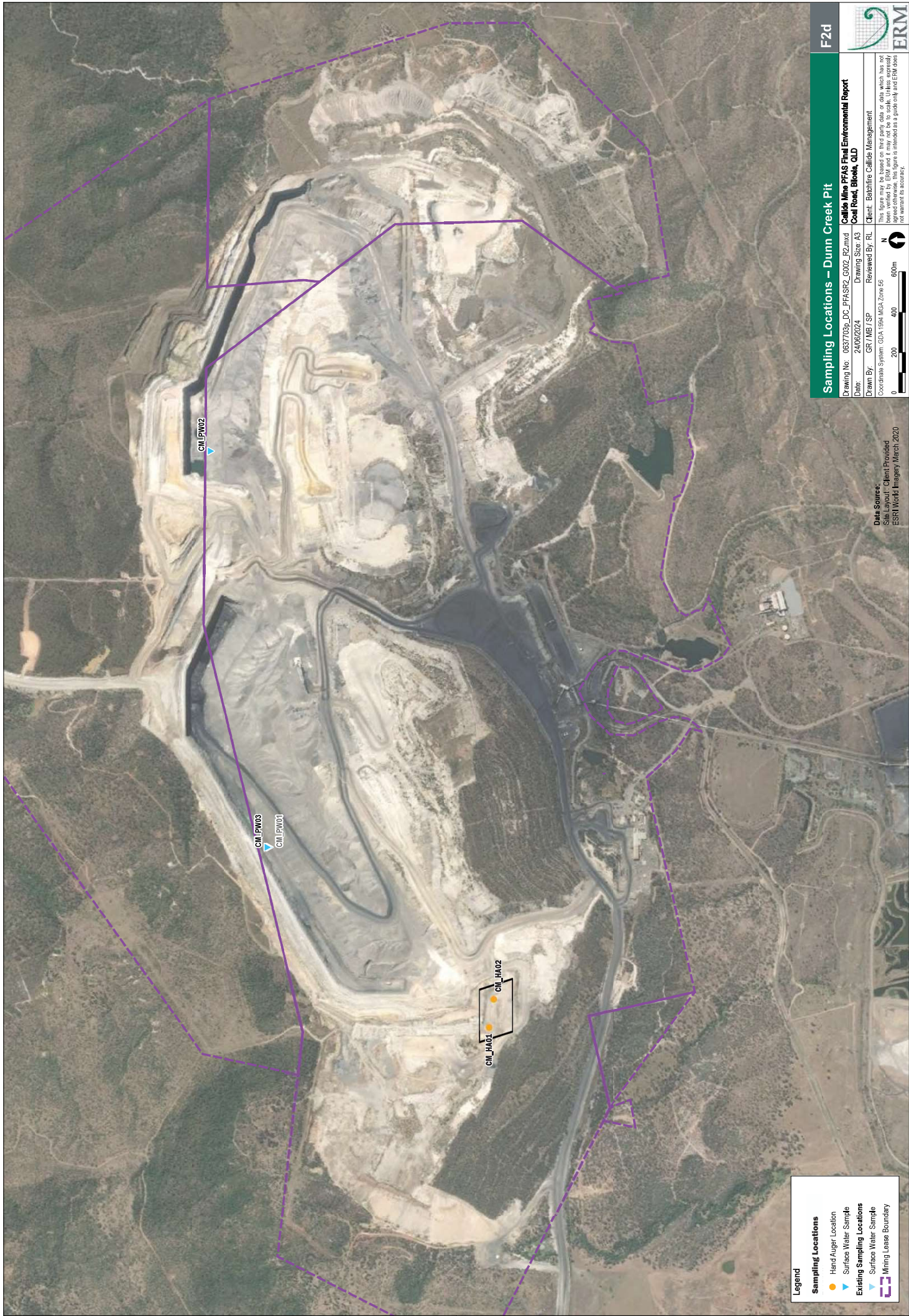
Calide Mine PFAS Final Environmental Report
Coal Road, Blaine, QLD

Drawing No: 0637703p_HUL_PFAFR2_G002_R3.mxd
Date: 24/09/2024
Drawn By: GR / MB / SP
Reviewed By: RL

Client: Bathfibre Calide Management
Coordinate System: GDA 1984 MGA Zone 56
Scale: 1:5000

Data Source:
Site Layout: Client Provided
ESRI World Imagery March 2020

This figure is based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.





Legend

●

DSI Sampling Locations

▲

Surface Water Sample

●

Licensed Discharge Point

■

Mining Lease Boundary

—

Creeks / Drainage

—

Dams and Sediment Dams

➔

Surface Water Flow Direction

F3b



Boundary Hill Pit Water Sampling Locations

Drawing No: 0837703p_BHM_PPASR2_G003_R1.mxd

Client: Bathfibre Calide Environmental Management

Date: 24/09/2024

Drawing Size: A3

Drawn By: GR / MB / SP

Reviewed By: RL

Coal Road, Blende, QLD

Coordinate System: GDA 1984 MGA Zone 56

0

200

400

600m

N



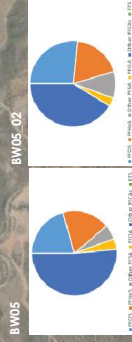
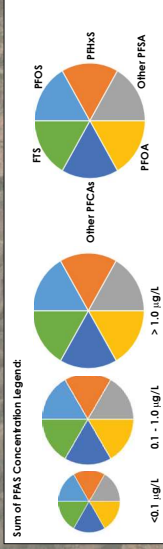
Data Source:

Site Layout, Client Provided

ESRI World Imagery March 2020

This figure has been prepared using data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.

Water Results			
		PFHs	PFOS
		µg/L	µg/L
	Units	0.0005	0.0002
		0.07 [^]	0.07 [^]
		0.00023	0.13
		2	2
		2	2



Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

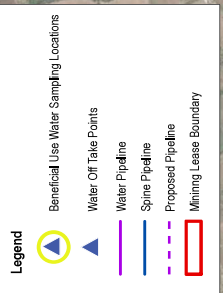
Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Sample	Date	PFHs	PFOS	PFHs and PFOS
BW05	31/08/2022	0.0389	0.044	0.0829 [^]
BW05_2	29/03/2023	0.0648	0.0931 [^]	0.158 [^]

Notes:

- BW02 is from a tank valve and supplies the Poulsons.
- BW03 is from a tank valve and supplies the Sheppards.
- BW04 is from a pipe value adjacent Ghost Ryder's Dam and supplies the Brosnans (piggy).
- Sample value installed at pipeline near off-site tank south of Boundary Hill (BW05).

Note: volumes reported in Blue re an estimate based on flow meter readings extrapolated to a one year timeframe. Values in Red indicate the estimated yearly provision of water to the landholder



Beneficial Water Use Agreements - Sample Tap Locations and Results

Drawing No: 0637703p_CM_PFA82_G002_R4.mxd
 Date: 24/06/2024
 Drawn By: GR / MB / SP / PM
 Reviewed By: PM
 Client: Batchline Calidate Management
 Coal Road, Block, QLD
 Coordinates System: GDA 1984 MGA Zone 56
 This plan may be based on best early data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.



ERM

APPENDIX B WORK PLANS

APPENDIX CONTENTS LIST

Work Plan - Southern Operations (including SAQP)

Work Plan - Boundary Hill (including SAQP)



Batchfire Callide Management Pty Ltd

Batchfire Boundary Hill Coal Mine, Coal Road, Biloela, Queensland

Boundary Hill Mine Site Per- and Poly-
Fluoroalkyl Substances Stage 2 Detailed
Site Investigation 2023 Work Plan

14 September 2023

Project No.: 0637703A-2

Document details	
Document title	Batchfire Boundary Hill Coal Mine, Coal Road, Biloela, Queensland
Document subtitle	Boundary Hill Mine Site Per- and Poly-Fluoroalkyl Substances Stage 2 Detailed Site Investigation 2023 Work Plan
Project No.	0637703A-2
Date	14 September 2023
Version	6.0
Author	Ross Lawrence, Patrick Mason
Client Name	Batchfire Callide Management Pty Ltd

Document history

Version	Revision	Author	Reviewed by	ERM approval to issue		Comments
				Name	Date	
Draft	1.0	Ross Lawrence	Kathryn East	Chris Gimber	30.05.2022	Draft for client review
Final	2.0	Ross Lawrence, Patrick Mason	Kathryn East	Chris Gimber	09.06.2022	Incorporate client and auditor comments
Draft	3.0	Ross Lawrence, Patrick Mason	Ross Lawrence	Neil Donaldson	03.04.2023	2023 update to Work Plan
Draft	4.0	Ross Lawrence, Patrick Mason	Ross Lawrence	Neil Donaldson	08.05.2023	Incorporate client comments
Draft	5.0	Ross Lawrence, Patrick Mason	Ross Lawrence	Chris Gimber	26.07.2023	Incorporate CLA comments
Final	6.0	Ross Lawrence, Patrick Mason	Ross Lawrence	Chris Gimber	14.09.2023	Incorporate CLA comments

Signature Page

14 September 2023

Batchfire Boundary Hill Coal Mine, Coal Road, Biloela, Queensland

Boundary Hill Mine Site Per- and Poly-Fluoroalkyl Substances Stage 2 Detailed Site Investigation 2023 Work Plan

Ross Lawrence
Senior Environmental Scientist

Patrick Mason
Project Manager and Hydrogeologist

Ken Kiefer
Technical Director

Chris Gimber
Partner

ERM Australia Pacific Pty Ltd
Level 14 207 Kent Street
Sydney NSW 2000

© Copyright 2023 by The ERM International Group Limited and/or its affiliates ('ERM'). All Rights Reserved. No part of this work may be reproduced or transmitted in any form or by any means, without prior written permission of ERM.

CONTENTS

1.	INTRODUCTION	1
1.1	Overarching Strategy	1
1.2	Background	1
1.3	Objectives	3
2.	SITE DESCRIPTION	4
3.	REGULATIONS, POLICIES AND MEASURES	5
3.1	Adopted Criteria	5
3.1.1	Soil and Sediment Samples	5
3.1.2	Concrete Samples	6
3.1.3	Surface Water Samples	6
3.1.4	Groundwater Samples	7
3.1.5	Biota Samples	8
4.	DATA QUALITY OBJECTIVES	8
4.1	Step 1: State the Problem	9
4.2	Step 2: Identify the Decisions	9
4.3	Step 3: Identify Inputs to the Decisions	10
4.4	Step 4: Define the Study Boundaries	10
4.5	Step 5: Develop a Decision Rule	11
4.6	Step 6: Specify the Performance or Acceptance Criteria	11
4.7	Step 7: Optimise the Design for Obtaining Data	11
5.	PROPOSED SCOPE OF WORK AND METHODOLOGY	12
5.1	Stage 2 DSI	12
5.1.1	Soil Sampling	14
5.1.2	Sediment Sampling	15
5.1.3	Concrete Sampling	15
5.1.4	Surface Water Sampling	16
5.1.5	Groundwater Sampling	18
5.2	Stage 2 DSI	20
5.2.1	Biota Sampling	20
5.3	Investigation Derived Waste	21
6.	LABORATORY ANALYSIS	21
6.1	Quality Assurance and Quality Control	21
7.	REPORTING	22
7.1	DSI Report (CLID)	22
7.2	Final Environmental Report	22
8.	REFERENCES	23
9.	IMPORTANT LIMITATIONS AND CONTEXT	24

APPENDIX A FIGURES

List of Tables

Table 2-1: Site Identification.....	4
Table 3-1: Summary of Surface Water EVs and Adopted Criteria.....	6
Table 3-2: Summary of Groundwater EVs and Adopted Criteria.....	7
Table 4-1: Decision Rules.....	11
Table 5-1: Soil Investigation Locations, Analysis, and Rationale	14
Table 5-2: Surface Water Investigation Locations, Analysis, and Rationale	16
Table 5-3: Groundwater Investigation Locations, Analysis, and Rationale	18
Table 5-4: Water Quality Parameter Stabilisation Criteria	20

List of Figures

- Figure 1 – Callide Mine Boundary Hill – Site Location
- Figure 2 – Sampling Locations – Boundary Hill
- Figure 3 – Boundary Hill Pit Water Sampling Locations

Acronyms and Abbreviations

Name	Description
AFFF	Aqueous Film Forming Foam
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure
Batchfire	Batchfire Callide Management Pty Ltd
CSM	Conceptual Site Model
DES	Queensland Department of Environment and Science
DSI	Detailed Site Investigation
ERM	ERM Australia Pacific Pty Ltd
EV	Environmental Value
FTA	Fire Training Area
FtS	Fluorotelomer sulfonic acids (Fluorotelomers)
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
LOR	Limit of Reporting
MIA	Mine Infrastructure Area
MSDS	Material Safety Data Sheet
PFAA	Perfluoroalkyl Acids
PFAS	Per- and Poly-Fluoroalkyl Substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFHxA	Perfluorohexanoic acid
PFAS NEMP	PFAS National Environmental Management Plan
PSD	Particle Size Distribution
PSI	Preliminary Site Investigation
QA/QC	Quality assurance / quality control
SPR	Source-Pathway-Receptor
SQP	Suitably Qualified Person
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOF	Total Organic Fluorine
TOPA	Total Oxidisable Precursor Assay
WQO	Water Quality Objective

1. INTRODUCTION

This Work Plan has been prepared as the second stage of works following an initial Detailed Site Investigation (DSI) by ERM Australia Pacific Pty Ltd (ERM) on behalf of Batchfire Callide Management Pty Ltd (Batchfire) to outline the strategy to assess Per- and Poly-fluoroalkyl Substances (PFAS) in environmental media at the Boundary Hill Mine Site.

Batchfire transitioned all fluorinated Aqueous Film Forming Foams (AFFF) to fluorine-free AFFF, in line with the Queensland Department of Environment and Science (DES) (2016) *Operational Policy – Environmental Management of Firefighting Foam* in 2019. As part of this process, Batchfire prepared a *Disposal Plan – Aqueous Film Forming Foam (AFFF)*, between June and November 2019, and commissioned ERM to undertake a voluntary PFAS Preliminary Site Investigation (PSI) at the site. However, during the course of this investigation, and based on discussions with DES, an Environmental Evaluation Notice (EEN) was issued on 16 December 2021 (DES reference: STAT-E-100078550).

Requirement 5 of the EEN includes development and submission of a Work Plan outlining the overall investigation strategy for the Detailed Site Investigation (DSI), including a Sampling and Analysis Quality Plan (SAQP). The EEN acknowledges that the work plan may be carried out over several stages, if required, in order to obtain sufficient data to adequately evaluate the site. This Work Plan acknowledges that DES has agreed (Environmental Evaluation E-100078550 – Requirement 5 – SAQP Workplan – Clarification, dated 19 May 2022) that the scope of the DSI is limited to PFAS (and no other hazardous contaminants), and therefore the content requirements of a Contaminated Land Investigation Document (CLID) may not be met. Under these circumstances, clause 8 of the EEN may not be able to be satisfied as the EP Act does not allow the scope of a CLID to be limited. The Auditor's review of the DSI report will be conducted on this basis.

1.1 Overarching Strategy

The overarching strategy is to develop a sampling scope of work that effectively evaluates the nature and extent of PFAS contamination that may have been caused by any direct or indirect releases from the site to soil, surface water, groundwater or sediments. To maximise the efficient and sustainable use of resources associated with the investigations, a staged approach is proposed, as follows:

- Stage 1 – detailed soil, surface water, groundwater and sediment sampling targeting source areas identified in the PSI and addressing identified data gaps; and
- Stage 2 – Following review of the findings of Stage 1, additional data needs to be collected to further delineate the extent of impacts (vertically or laterally); or to provide additional lines of evidence to document any seasonal variability. Stage 2 sampling may also include biota sampling where the Stage 1 DSI sampling results indicate potentially complete Source-Pathway-Receptor (SPR) linkages exist. Now that the Stage 1 works have been carried out, the data gaps identified in the ERM document *Batchfire Callide Southern Mine – PFAS DSI Progress Update* are summarised below in Section 1.2 and 5.2. This revised work plan now details the Stage 2 sampling required to fill data gaps from the Stage 1 sampling activities and provide additional temporal data for seasonal conditions at the site.

1.2 Background

Historically, fluorinated AFFF (containing PFAS) has been used at the Callide Coal Mine Boundary Hill site, which is now operated by Batchfire (previously operated by Anglo American). PFAS has been released to ground as a result of fire systems maintenance, firefighting training and actual fire suppression events, where required. The *Boundary Hill Site Per- and Poly-Fluoroalkyl Substances Preliminary Site Investigation (2021-2022)*, *Batchfire Callide Coal Mine, Coal Road, Biloea, Queensland* (ERM, 28 April 2022) identified detectable concentrations in soil, surface water and groundwater within the Boundary Hill operations area.

Based on the preliminary Conceptual Site Model (CSM), the potentially complete Source-Pathway-Receptor (SPR) linkages include:

- Indirect exposure to the PFOS-impacted shallow soils for terrestrial ecosystems on-site at the former Fire Training Area (FTA);
- Direct contact with PFOS and PFHxS impacted surface water (exceeding DoH 2019 drinking water values) for on-site workers undertaking maintenance at sediment dams near the former FTA, or handling surface water associated with dust suppression, noting that this risk can be managed by implementation of safety protocols; and
- Aquatic ecosystems exposure to PFOS and PFHxS in surface water (exceeding 99% freshwater ecosystem protection values, and 95% values in some locations), on-site and potentially (although lower likelihood) off-site, given that significant dilution is expected to occur during overflow events from Lake Gasteen.

The following data gaps were identified following the Stage 1 DSI:

1. Soil sampling undertaken at the warehouse and maintenance workshop park-up areas indicated the presence of PFAS at shallow depth at sample BH_SB02 – 0.25m. The extent to this impact has been delineated vertically (0.5m sample) but not horizontally;
2. Soil sampling undertaken at the southern end of the administration building indicated the presence of PFAS at shallow depth at sample BH_SB05 – 0.5m. The extent of this impact has not been delineated either vertically or horizontally;
3. The extent of PFAS in shallow groundwater is limited to BH_MB05, located at the former FTA (the most impacted point within the site). PFAS has not been detected at concentrations exceeding the guideline values at any other monitoring bores at the site;
4. Two concrete cores were collected from the east and west side concrete aprons of the workshop, while there was a PFAS exceedance from the upper sample of BH_CON01 (collected on the western side of the workshop), the lower sample from the same core was less than the relevant guideline values. ASLP leaching tests confirmed that the concrete was highly leachable and therefore constituted a potential ongoing source of PFAS contribution to the environment;
5. The actual volume of beneficial re-use water supplied from the mine site has been estimated but not precisely quantified. Water flow meters are currently being fitted to all off-takes. The beneficial water investigation is included in the Southern Operations Work Plan, DSI and reporting;
6. Groundwater flow direction – new groundwater bores need to be surveyed and geological maps reviewed to confirm which bores are screened across equivalent units. Based on the geological units encountered during drilling, it appears that ERM should be able to estimate groundwater elevations and flow direction at Boundary Hill;
7. Surface water seasonal flows – obtain surface water samples opportunistically during significant rainfall events, where run-off is observed originating from source zones (particularly the former Fire Training Area), and resample along various points of Gate Creek to the south of the small dam (sample BH_SW17) south of Lake Gasteen; and
- 8.
9. Two of the proposed Boundary Hill pit water samples were unable to be obtained, one due to current operational activities and one due to the pit being dry. Whilst it would be prudent to characterise these water bodies, it is not deemed critical to the project (and they are considered unlikely to be major contributors to the overall PFAS concentrations).

In order to meet Requirement 5 of the EEN, a Work Plan outlining the proposed approach to sampling and analysis for a DSI that focuses on filling the data gaps of the PSI and the preliminary CSM is required. The Stage 1 work plan has been completed; however, some data gaps remain to be

addressed by this Stage 2 (revised Stage 1) work plan. The Sampling and Analysis Plan (SAP) is included in the work plan.

1.3 Objectives

The objectives of the DSI are to characterise the nature and extent of PFAS impact in environmental media associated with any direct or indirect releases of PFAS at the site, specifically focusing on addressing the data gaps identified in the Stage 1 DSI (outlined above).

Further, the Boundary Hill DSI (in line with EEN Requirement 6 and Requirement 9) will seek to:

- a. Identify any and all pathways relevant to the migration of potentially impacted surface water or groundwater (addressing data gaps 1-2, 4-7 and 8 above);
- b. Assess the potential connectivity between groundwater and surface water (addressing data gaps 1-8 above);
- c. Assess samples of all environmental media for the presence of PFAS precursors (via Total Organic Fluorine (TOF) and Total Oxidisable Precursor (TOP) Assay analysis), addressing the requirements of the EEN; and
- d. Obtain data on grainsize fractions and organic carbon content in sediment samples to allow standardization when comparing data from different locations.

Note: Requirement “6, c” of the EEN has not been included in the Boundary Hill Work Plan, as it is not proximal to Callide Dam.

2. SITE DESCRIPTION

Site identification details are summarised in Table 2-1 below.

Table 2-1: Site Identification

Item	Description
Site Name	Batchfire Boundary Hill Coal Mine
Site Address	Approx. 4km north of the turnoff from the Argoon-Kilburnie Rd on Unnamed Road, 22km north of Biloela, Queensland 4175
Property Identification	Lot 153 RN1431 (structures and part of Lake Gasteen), Lot 11 RP801163 (coal loading facility, FTA and part of Lake Gasteen), Banana Shire Council
Site Area	42 Ha
Owner	Batchfire Callide Management Pty Ltd (comprising 66.7% Batchfire Callide Pty Ltd and 33.33% Batchfire Callide No 2 Pty Ltd)
Land Use Zoning	Mining
Current Land Use	Mining

The Boundary Hill mine includes an operational facility, comprising vehicle parking areas, offices, crib rooms, an ablutions block, large vehicle workshop, vehicle wash bay and associated infrastructure such as equipment storage areas and laydown areas. Three large above ground storage tanks (ASTs) containing diesel fuel are located to the east of the main workshops, where a refuelling area has been installed. The crib room, administration building, workshops and ancillary structures are collectively referred to as the Mine Infrastructure Area (MIA). The site location is shown on *Figure 2, Appendix A*.

Surface water drainage from the MIA is directed to treatment ponds to the north of the workshops/wash bays and then to a series of sediment ponds, with surface water ultimately discharging into Lake Gasteen, a large artificial water storage impoundment to the south-west of the MIA. Lake Gasteen is a valley fill dam created at the headwaters of Gate Creek, which runs from north to south. Stormwater runoff from the unsealed surface on the western side of the workshops may discharge directly to Lake Gasteen.

Coal stockpiling occurs in an area to the north-east of the MIA, with a conveyor belt system moving the coal to a coal processing plant and further stockpiling area located to the west of the stockpile area. From the processed coal stockpile area there is a loading facility with a rail loop to transport coal to an export terminal.

Some operational areas of the site have been built up using waste rock material that was stripped from above the coal deposits (referred to as “shot rock”). The workshops and administration facilities are elevated slightly above the natural ground level and most of the site roadways are surfaced with shot rock to form trafficable surfaces.

The former fire training area (referred to as FTA1) was established slightly to the south of the coal conveyor system on raised ground just north of Sediment Dam 2 (refer to *Figure 2, Appendix A*). Steel trays containing scrap items and diesel fuel were set alight and extinguished using legacy fluorinated AFFF mixed with water. A small concrete slab located at FTA1 was used for the storage of small drums of AFFF. The surface run-off drained directly south to Sediment Dam 2 from FTA1. Water from Sediment Dam 2 then drains further south to Lake Gasteen. There is a sewage treatment system located between Lake Gasteen and the workshops. A pump is installed at Lake Gasteen for the extraction of water for commercial/industrial uses within the maintenance area, such as for dust suppression and vehicle washdown. A vehicle washdown area is located to the north of the workshops and drains to the treatment ponds.

An explosives magazine is located approximately 750m north of the MIA. This magazine is accessed via an area that has been built up with shot rock to serve as a laydown area, mainly for drilling equipment. Part of the laydown area is also used for rescue training using damaged vehicles and for fire training (referred to as FTA2, or the current FTA). The steel fire trays from FTA1 were moved to FTA2 and reused for ongoing fire training.

Site location and site features are presented in *Figures 1-3, Appendix A*.

3. REGULATIONS, POLICIES AND MEASURES

The investigation will be undertaken in reference to the following regulations, guidelines, and policy documents:

1. *Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2018* (ANZG 2018);
2. *Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2023* (ANZG 2023, *Toxicant default guideline values for aquatic ecosystem protection: Perfluorooctane sulfonate (PFOS) in freshwater*;
3. *DES Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (DES 2019);
4. *Department of Environment and Heritage Protection Queensland Water Quality Guidelines 2009* (DEHP 2009);
5. *DES Monitoring and Sampling Manual: Environmental Protection (Water) Policy* (DES 2018);
6. *Heads of EPAs Australia and New Zealand PFAS National Environmental Management Plan Version 2.0* (HEPA 2020);
7. *NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999* (amended 2013) (Assessment of Site Contamination [ASC] NEPM); and
8. *Queensland Government Environmental Protection Act* (1994).

3.1 Adopted Criteria

Adopting a risk-based approach as detailed in the national guidance (ASC NEPM), soil, sediment, surface water and groundwater results will be screened against established criteria drawn from PFAS NEMP guidance.

Where biota sampling is warranted, biota results will be screened against the criteria presented in the PFAS NEMP and with reference to the Queensland Health Guideline for the edible portions risk of exceeding the tolerable daily intake and the Food Standards Australia and New Zealand (FSANZ) for portion sizes. An evaluation of the bioaccumulation species risk will form part of this assessment.

Based on the current land use for mining, with agricultural and recreational uses in the surrounding areas, ERM proposes adopting the criteria outlined in the sections below.

3.1.1 Soil and Sediment Samples

The adopted soil and sediment criteria consider current zoning and land use of the site, the surrounding land use and potential contamination pathways. As such, the following criteria have been nominated for this investigation:

- PFAS NEMP (2020) Human health (direct contact) values for industrial / commercial;
- PFAS NEMP (2020) Human health (direct contact) values for public open space;
- PFAS NEMP (2020) Interim ecological (direct contact) values for all land uses; and
- PFAS NEMP (2020) Interim ecological (indirect exposure) values for all land uses.

As noted in the PFAS NEMP (HEPA, 2020), these interim soil guidelines lack consideration of transport and leaching of PFAS from soil or sediment into groundwater and surface water (whereby PFAS may be mobilised to off-site locations). A neutral rainwater simulation leach (Australian Standard Leaching Procedure (ASLP)) will be applied to selected soil and sediment samples. For assessment of the potential impacts on wildlife and aquatic biota and in conjunction with environmental variability, the surface water criteria in Table 3-1 and groundwater criteria in Table 3-2 for the relevant environmental values will be applied to the ASLP results.

3.1.2 Concrete Samples

Concrete surfaces in the workshop area (one of the source zones identified in the PSI) may be impacted with PFAS, which may be acting as a secondary source (if PFAS leaches out of the concrete over time) and could result in impacted groundwater or stormwater runoff. Concrete samples will be treated in a similar manner to soil and sediment samples after laboratory processing. The following soil criteria have been nominated for the concrete investigation; however, criteria may need to be reviewed given the exposure mechanisms between soil or sediment and concrete are not equivalent (i.e., the risk of exposure to PFAS in concrete would be considered lower than in soil):

- PFAS NEMP (2020) Human health (direct contact) values for industrial / commercial;
- PFAS NEMP (2020) Human health (direct contact) values for public open space;
- PFAS NEMP (2020) Interim ecological (direct contact) values for all land uses; and
- PFAS NEMP (2020) Interim ecological (indirect exposure) values for all land uses.

Concrete samples will also be analysed for PFAS ASLP to assess the potential for PFAS leaching from the concrete into soils, groundwater or surface water. Surface water criteria listed in Table 3-1 and groundwater criteria listed in Table 3-2 for the relevant environmental values (EVs) will be applied to these results. The proposed sampling methodology (which will influence the results and applicability of criteria) is outlined in Section 5. However, given the potential safety and/or access limitations near the workshops, the methodology for collection and preparation of concrete samples may need to be revised at the time of conducting site work, in discussion with Batchfire and the Auditor.

3.1.3 Surface Water Samples

The adopted surface water criteria consider the surface water EVs for the Callide Creek Catchment, based on the DEHP (2011) document. Gate Creek on the Boundary Hill site flows to Callide Creek to the south-west of the site. Adopted surface water criteria are summarised in Table 3-1, below.

Table 3-1: Summary of Surface Water EVs and Adopted Criteria

Environmental Value	Supporting Information	Screening Criteria
Aquatic ecosystems	Lake Gasteen is the final receiving water body within the site. This lake was created as a valley fill catch dam located in the former channel of Gate Creek. Any overflow from Lake Gasteen will flow to the south into Gate Creek. Gate Creek joins Callide Creek approx. 10km south-west downstream of Lake Gasteen. Based on the PFAS NEMP (2020) and ANZG (2018), 99% species protection values should be applied for bioaccumulative substances.	PFAS NEMP V2.0, 2020 – freshwater 99% species protection
Industrial use	A pump is fitted at Lake Gasteen for the reuse of water within the mine site for dust suppression and vehicle wash-down purposes.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water (given that there are currently no specific guideline values for this EV))
Drinking water	Water from Lake Gasteen is supplied to landholders under the Beneficial Water reuse Scheme, is not intended to be supplied for potable use, and preliminary survey of all landholders has confirmed they do not use for potable water. All potable water used on-site is trucked into the Boundary Hill site. Bore water from off-site bores is used in the washroom facilities.	DoH (2019) Australian Drinking Water Quality Guideline Values

Environmental Value	Supporting Information	Screening Criteria
Irrigation, farm supply/use, stock water	A number of landholders have beneficial water reuse agreements with Batchfire. Water from Lake Gasteen is used to supply landholders via a dedicated pipeline. This water is used for stock watering or irrigation purposes (including domestic non-potable use, such as for watering lawns).	DoH (2019) Australian Drinking Water Quality Guideline Values (conservatively applied, given that there are currently no specific guideline values for these EVs)
Visual, Primary and secondary recreation	EVs for Callide Creek and associated tributaries are listed as being visual, primary and secondary recreation activities (e.g. boating and fishing).	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water
Cultural and spiritual values	Gate Creek is a minor tributary of Callide Creek. Callide Creek is considered to hold cultural and spiritual value. There are no specific criteria associated with cultural and spiritual values. However, the water quality objectives adopted for the protection of other beneficial uses, such as recreation, water dependent ecosystems and their species, in part, protect these EVs. Consumption of organisms and plants may form part of the cultural values.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water
Human consumer	Recreational activities such as swimming, boating and fishing may result in consumption of PFAS impacted organisms or ingestion of PFAS impacted water.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water

ERM notes that human consumer is listed as an EV of the Callide Creek catchment area, however, no biota sampling has been conducted to date. If potential risks associated with bioaccumulation of PFAS in biota and/or consumption of PFAS affected organisms are identified, biota sampling will be required to quantify the risk. The sampling (if required) would be carried out in addition to the Stage 2 DSI. This risk would be assessed via a Human Health and Environmental Risk Assessment (HHERA).

3.1.4 Groundwater Samples

The adopted groundwater criteria consider current and future zoning and land use of the site and the groundwater EVs, based on the DEHP (2011) guidance. As such, the criteria adopted for the protection of these EVs are summarised in Table 3-2, below.

Table 3-2: Summary of Groundwater EVs and Adopted Criteria

Environmental Value	Supporting Information	Screening Criteria
Aquatic ecosystems	Shallow groundwater flows may discharge to Lake Gasteen, the topographical low point within the investigation area. Based on the PFAS NEMP (2020) and ANZG (2018), 99% species protection values should be applied for bioaccumulative substances.	PFAS NEMP V2.0, 2020 – freshwater 99% species protection
Irrigation, farm use or stock watering	Shallow groundwater flows may discharge to Lake Gasteen. Water from Lake Gasteen (which can occasionally be supplemented by water pumped from other water bodies, e.g., Ghost Ryders Dam or East Dam, via the Spine Pipeline) is provided to local landholders for irrigation and stock watering under a beneficial reuse agreement. However, the potential that groundwater is currently or will in the future be extracted for irrigation, farm use, or stock watering cannot be excluded.	DoH (2019) Australian Drinking Water Quality Guideline Values (conservatively applied, given that there are currently no specific guideline values for these EVs)

Environmental Value	Supporting Information	Screening Criteria
Industrial Use	Shallow groundwater flows may discharge to Lake Gasteen, and water from Lake Gasteen is used for dust suppression activities on-site. At the Boundary Hill site, groundwater is currently extracted directly for industrial use on-site from the Kilburnie 1 and Kilburnie 2 bores that are screened in the precipice sandstone. This water is used for non-potable uses but does include the bathhouse showers.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water (given that there are currently no specific guideline values for this EV)
Drinking water	No registered bores were reported within a 500m radius of the MIA for potable use. However, the potential that groundwater is currently or will in the future be extracted for drinking water use cannot be discounted.	DoH (2019) Australian Drinking Water Quality Guideline Values
Intrusive maintenance workers (commercial / industrial)	Shallow aquifers may exist that are currently not monitored. Groundwater flow direction has not been established and impacted groundwater may flow into mine voids.	DoH (2019) Australian Drinking Water Quality Guideline Values (conservatively applied, given that there are currently no specific guideline values for these EVs)

3.1.5 Biota Samples

Where soil, sediment, surface water and/or groundwater data indicates the potential for risks to aquatic or terrestrial ecosystems, the need for biota sampling may be triggered. No biota sampling has been included in Stage 1 or Stage 2 of the DSI sampling, but this Stage 2 Work Plan (and incorporated SAQP) includes off site sampling of surface water, soil and organic matter (biomass) where the results of a landowner survey on the use of beneficial water indicates that this is warranted.

Where biota is sampled, an assessment of edible portions will be used in estimating the risks of exceeding the tolerable daily intakes. Reference documents for this assessment include:

- Queensland Health Guideline (for sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination); and
- Food Standards Australia and New Zealand (FSANZ) (for the adoption of portion sizes).

4. DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) have been developed to define the type and quality of data required to achieve the overall objectives of the assessment; being to fully characterise the nature and extent of PFAS impact in environmental media associated with any direct or indirect releases of PFAS at the site.

The Stage 1 PFAS data from the site has been assessed against criteria protective of identified human health and ecological receptors relevant to the current and future land uses.

The DQOs (outlined below) were developed with reference to the Heads of Environmental Protection Agencies (HEPA) PFAS National Environmental Management Plan (NEMP) (2020), Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality, Volume 1, October 2000 (ANZECC 2018) and the National Environmental Protection Council (NEPC) 1999, amended 2013. *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM 2013) guidelines, which define minimum data requirements and quality control procedures.

Following on from the Stage 1 DSI, soil and water data gaps were identified in the following areas:

- Surface water sample BH_SW16, unable to be collected from north of the MIA due to dry conditions, no water in the flow channel;

- Pit water sample BH_PW02 was unable to be collected from the northern pit during the Stage 1 DSI due to operational activities;
- Impacted soil was identified at BH_SB02 parking/laydown area east of the workshop and BH_SB05 south of the office/admin building on the southern edge of the MIA on the site, which have not been delineated laterally. Additional soil samples are required to the north and south of the original locations;
- Revalidation of groundwater from all groundwater monitoring wells;
- Revalidation sample (BH_SW20) from the Lake Gasteen discharge point (RP3) to add to temporal data;
- Revalidation sample of the surface water sample (BH_SW21) in the upper dam on Gate Creek, and;
- New surface water sample (BH_SW22) from the lower dam on Gate Creek to verify PFAS migration via the Gate Creek surface water flow path.

4.1 Step 1: State the Problem

The objectives are to:

- Assess conditions in environmental media (soil, sediment, surface water and groundwater) against screening criteria relevant for the land use (mining/agricultural);
- Assess conditions in biota (if required by an updated SPR linkage) against relevant screening criteria, and;
- Produce a Stage 2 DSI (targeting only PFAS, as previously outlined in Section 1) for submission to the administering authority that demonstrates that Requirement 6 of the EEN has been met. Specific requirements of the EEN are to:
 - Assess the results of the Stage 1 DSI for PFAS impacts that require further investigation for delineation and for gaps in the Stage 1 sampling that require further investigation; Identify pathways including, but not limited to, the premises, surface waters, drainage lines, stormwater infrastructure and groundwater in the vicinity of the premises;
 - Assess the nature of the connectivity/completeness of those pathways by assessing groundwater levels versus surface water levels and connectivity, hydraulic conductivity and groundwater velocity, and evaluate the potential for contaminant migration offsite during heavy rainfall events, ensure that there is sufficient data to evaluate these pathways; and
 - The sampling and analysis must also take into account all requirements stated in Requirement 9 of the EEN.

It should be noted that the scope of the DSI is limited to PFAS (and no other hazardous contaminants), and therefore the content requirements of a CLID may not be met. Under these circumstances, clause 8 of the EEN may not be able to be satisfied as the EP Act does not allow the scope of a CLID to be limited. The Auditor's review of the DSI report will be conducted on this basis.

4.2 Step 2: Identify the Decisions

The decisions to be made based on the proposed scope of work and objectives are as follows:

- Do environmental media (soil, sediment, concrete, surface water, groundwater and biota, where appropriate), meet the adopted criteria suitable for the current land use, and the protection of human health and ecological receptors?
- Have secondary source(s) of PFAS been identified that may represent an ongoing risk to downstream receptors, requiring the application of additional screening criteria to assess the potential for indirect risks?

- Is the data collected during this investigation sufficient to provide an assessment of the environmental condition and extent of any existing contamination to environmental media to support risk-based decision making?
- Do residual impacts (if any) represent a potential risk to identified human health (industrial workers) and ecological receptors, agricultural use and off-site / adjacent residents and potentially the food chain?
- Does the data obtained meet the requirements of the EEN?

4.3 Step 3: Identify Inputs to the Decisions

The inputs required to make the above decisions are:

- Identification of representative sampling locations, including in areas where a PFAS impact has been identified but not delineated;
- Groundwater and surface water field screening data (pH, dissolved oxygen, redox potential, conductivity and turbidity);
- Determining groundwater and surface water interactions, groundwater recharge or discharge and groundwater flow rates and direction/s from the Stage 1 DSI results;
- Are concentrations of PFAS compounds present in surface water and groundwater at site discharge points;
- Do concentrations of PFAS compounds in soil and sediment and the leachability of PFAS in soil and sediment present a risk to human health and ecological receptors;
- Do PFAS concentrations in concrete aprons and floors at the workshop, and its leachability, present an on-going source of PFAS that may impact human health and/or the environment;
- Bioaccumulation and biomagnification of PFAS in biota (if off-site this will be carried out under the Southern Operations DSI);
- Field and laboratory quality assurance/quality control data; and
- Adopted screening levels outlined in Section 3, above.

4.4 Step 4: Define the Study Boundaries

The spatial boundaries are shown on *Figures 1-2, Appendix A* as the site and cadastral boundary of Lot 153 RN1431 (structures and part of Lake Gasteen), Lot 11 RP801163 (coal loading facility, former FTA and part of Lake Gasteen). The mine lease boundaries are also shown on *Figure 2, Appendix A*. It should be noted that the mine lease boundaries and Lot boundaries do not always align.

The temporal boundaries of this investigation for water are to carry out surface water and groundwater gauging and sampling at selected times during a dry season and a wet season (at least one sampling event each) between July 2022 and July 2023 in order to assess the potential for seasonal variability. This includes beneficial reuse water samples from the Spine Pipeline off-takes.

Soil sampling from soil bores and from the new groundwater monitoring bores were conducted as part of the Stage 1 DSI sampling. Sediment sampling of water storage dams were also carried out during the Stage 1 DSI, as well as concrete sampling at the MIA workshop aprons. Further soil sampling will be conducted in additional areas identified during the Stage 1 DSI to assess the potential soil contamination away from the workshop area.

Biota sampling, if required, is proposed to be carried out as an addendum to the Stage 2 DSI, at an appropriate time of the year when the biota may be expected to be abundant. The timing will be determined in consultation with specialists in biota sampling.

4.5 Step 5: Develop a Decision Rule

Laboratory analytical data will be assessed against the criteria as identified in Section 6.

Table 4-1: Decision Rules

Decision Required to be Made	Decision Rule
Is data acquired of acceptable quality for interpretive purposes?	Have appropriate controls and operating procedures been used, specifically: ■ Consistent sampling methods with appropriate sampling equipment with respect to PFAS, including appropriate decontamination procedures; ■ Analytical techniques, both standardised method and detection limits appropriate to assessment criteria for different laboratories and for the same laboratories over time; and ■ QA/QC controls (field and lab) for samples recovered and tested are undertaken in accordance with the relevant stated quality parameters (as referred to in Section 6.1). If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No.
Has a sufficiently robust conceptual site model (CSM) been established?	The CSM has been progressively developed from the data obtained during the PSI and Stage 1 DSI investigations and follows the ASC NEPM (2013) and the PFAS NEMP (HEPA 2020) guidance. Data gaps identified in the later DSI have been targeted with the Stage 2 DSI sampling plan. Source – pathway – receptor linkages identified with the potential to be complete linkages have been targeted by the Stage 2 DSI to close these data gaps. If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No.
Based on soil, sediment, concrete, surface water, groundwater (and biota, if necessary) results, is the data obtained sufficient to provide an assessment of the environmental condition and extent of any existing contamination?	If there are exceedances of the adopted screening criteria (for the protection of receptors identified in the CSM), are there sufficient data inputs to the CSM to determine whether source-pathway-receptor linkages are presently complete or may be complete in the future? If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No.

4.6 Step 6: Specify the Performance or Acceptance Criteria

The acceptable limits on decision errors applied during the review of the results will be based on the data quality indicators of precision, accuracy, representativeness, comparability, and completeness, in accordance with the requirements of the ASC NEPM (2013).

The potential for significant decision errors will be minimised by:

- Completing a robust QA/QC assessment of the validation data and application of the probability that 95% of data will satisfy the DQIs, therefore a limit on the decision error would be 5% that a conclusive statement may be incorrect;
- Selection of appropriate screening levels that reflect the current and proposed future site use (mining/industrial); and
- Selection of appropriate screening levels that reflect current off-site uses, including the protection of human and environmental values for recreational and drinking water uses.

4.7 Step 7: Optimise the Design for Obtaining Data

This Draft Work Plan has been developed based on samples collected as part of the PSI (soil, sediment, surface water and groundwater) and the Stage 1 DSI (soil, sediment, concrete, surface water and groundwater). The Stage 2 DSI design is limited to soil, surface water and groundwater sampling as concrete and sediment samples collected during the Stage 1 DSI have been deemed

sufficient for the assessment of those potential pathways. The sampling design includes the following quality assurance measures:

- One intra-laboratory duplicate sample and one inter-laboratory duplicate sample per 10 primary samples collected (as required by the PFAS NEMP, 2020);
- One rinsate per field team member per day of sampling or per media type (whichever is greatest); and
- One trip blank sample per esky.

Rinsate samples will be submitted for PFAS (extended suite of compounds) analysis. Trip blank samples will be analysed for a PFAS short suite. Water samples (including rinsates and trip blanks) will be analysed to super ultra-trace limits of reporting (LORs), to enable comparison to PFAS NEMP default guideline values for 99% aquatic ecosystem protection and to test for potential cross-contamination.

Soil and sediment samples will be analysed to standard LORs. Soil and sediment samples will also be subjected to leaching tests with the criteria for water applied to the leachate solution analysis. The leachate solution will therefore be analysed for the PFAS extended suite at super ultra-trace LOR. Sediment will also be analysed for Particle size distribution (PSD) and total organic carbon (TOC). Laboratory QA/QC will be consistent with the requirements of PFAS NEMP.

Other PFAS-specific considerations / procedures that will be followed include:

- Sample locations with suspected elevated concentrations of PFAS will be sampled last, to limit the chance of sample contamination;
- All sample containers (to be provided by the selected laboratories) and consumable equipment (such as tubing for groundwater sampling) are to be polypropylene or HDPE (with no Teflon or Viton substances to be used); and
- No food wrappers, sticky notes, stain or water resistant clothing, reusable freezer blocks, sunscreen, or insect repellent, unless certified PFAS free, will be worn or used during any stage of sampling.

The need for additional scope – to be developed as “Stage 2” of the DSI (e.g., for lateral or vertical delineation, or for temporal / seasonal assessment, or biota sampling) has been determined at the completion of Stage 1 of the DSI, in consultation with the Contaminated Land Auditor. The Stage 2 DSI works plan contained within this document is expected to address the identified additional scope.

5. PROPOSED SCOPE OF WORK AND METHODOLOGY

5.1 Stage 2 DSI

Data gaps remaining from the Stage 1 DSI indicate potential pathways are present within the current CSM. Supplementary samples will be collected where insufficient data is available to determine if a pathway is complete or not. Supplementary sampling may include:

- Resampling of groundwater monitoring bores to confirm the presence/absence of PFAS compounds from the Stage 1 results. The additional groundwater sampling will add temporal data and assist with the development of a model of groundwater movement;
- Resampling of surface water within the site to confirm Stage 1 results. Additional surface water sampling will add temporal data to the site assessment. Additional new surface water body sampling will be used to assess PFAS migration via surface water flow paths;
- Surface water and soil/sediment sampling of off-site receiving water bodies (subject to landholder questionnaire and property access), including those downgradient of off-site areas irrigated with beneficial reuse water;

- Organic matter sampling, on-site and/or off-site (subject to landholder questionnaire and property access);
- Sampling of seasonal surface water flows on an opportunistic basis; and/or
- Seepage monitoring of on-site dams.

The ERM Batchfire Callide PFAS DSI 2022 Progress Summary report (ERM - Dec 2022) following the Stage 1 DSI indicates that either potential pathways exist in surface water flow path areas of the Boundary Hill site and that the PFAS impact is not fully delineated in the areas to the northeast and southwest of the main workshop infrastructure of the site. Furthermore, some samples were unable to be collected due to operational activities such as coal extraction activities in the northern pit. Stage 2 of DSI sampling will undertake the sampling of four media (soil, sediment, surface water and groundwater) for the delineation of PFAS impacts within the mine site. ERM will also attempt to collect any previously missed samples in order to close out data gaps. A summary of the Stage 1 DSI data gaps is presented in Table 5-0 below.

The Stage 2 DSI will also address off-site sampling of surface water (if present) soil and organic matter (biomass) based on the application of beneficial water (BW) supplied from the mine site. A landowner questionnaire has been prepared by Batchfire for distribution to landowners and the results of this questionnaire will determine the type sampling to be undertaken and the media to be sampled.

The data gained from these activities will inform the draft CSM and develop it further by closing data gaps that currently exist.

Table 5-0: Summary of Stage 1 DSI Sample Gaps

Location	Media	Identified Data Gap/s	Nearby Impacted Samples
East side of Boundary Hill workshop	Soil	PFAS impact not delineated to the north and south of impacted surface sample locations	BH_SB02
South side of Boundary Hill Offices	Soil	Impacted soil to the south of the main admin/offices not delineated to the south and southeast.	BH_SB05
Surface water flow path	Water	Missed surface water sample BH_SW16 of the flow channel to the north of the MIA in the Stage 1 DSI due to being dry.	None, missed sample
Groundwater monitoring bores	Water	Additional temporal (seasonal) data for the sites groundwater model	BH01, MB08, MB28, BH_MB01, BH_MB02, BH_MB03, BH_MB05
Surface water bodies	Water	Additional temporal data for the sites surface water interpretation	Lake Gasteen discharge point (RP3), upper dam on Gate Creek
Pit water	Water	Site pit water missed sample at Boundary Hill pit during the Stage 1 DSI.	BH_PW02

5.1.1 Soil Sampling

Prior to commencing any intrusive works, all sub-surface services will be located and marked on the ground (by Batchfire or their subcontractor). Dial Before You Dig (DBYD) plans will be consulted where available and ERM's sub-surface clearance program will be carried out to the extent possible to document the clearance process. Batchfire will also initiate an internal ground disturbance permit process prior to commencing drilling. Soil bores will be advanced by hand auger to a maximum of 1mbgs. An experienced ERM environmental scientist/engineer will log the soil strata and collect soil samples.

The rationale for soil sampling is included in Table 5-1 below. Note that two soil samples will be selected for analysis from each soil bore where possible, any remaining soil samples collected at each bore will be shipped to the analytical laboratory and placed on hold, pending the need for further vertical delineation.

In order to be able to delineate any surface soil impacts vertically, soil samples will be collected from deeper within the soil profile where possible. As a general rule, an interval of 0.5m between samples will be attempted throughout the vertical profile near the surface, however the field technician/s collecting the soil samples will use their discretion to vary this interval where soil strata are encountered such as rock layers, highly permeable sands or highly impermeable clays.

Deeper soil samples that are placed on hold at the laboratory may be analysed where the upper sample exceeds the site criteria for PFAS compounds. Where impacted soil samples are deemed to be within an area of the site that may allow PFAS to migrate off site (for example, sediment in a flow path leading to the site boundary), the soil sample may also be subjected to ASLP testing to determine the potential for PFAS to migrate to down gradient receptors. Samples selected for ASLP testing will therefore not necessarily have the highest concentrations of PFAS compounds.

Selected samples with the highest primary PFAS concentrations will be subjected to TOP Assy to establish the total detectable PFAS concentrations. This process results in otherwise unknown precursor fluorinated compounds becoming detectable as PFAS and the total of PFAS pre-TOPA is usually less than the sum of PFAS post-TOPA. The QA assessment of the laboratory results should include a check of the pre and post TOPA PFAS totals to ensure that the above statement is true.

Table 5-1: Soil Investigation Locations, Analysis, and Rationale

Location ID	Number of Samples	Analytical Suite	Rationale
BH_SB07 – BH_SB08	6 (2 primary, 2 intra-lab & 2 inter-lab duplicate)	6 x PFAS extended suite 2 x TOP Assay (samples selected after PFAS results) 1 x TOF 2 x ASLP PFAS	Delineate PFAS impact in soil around the workshop area source zone. Samples to be collected in the parking area to the north and south of BH_SB02 location. Soil bores are to be advanced to up to 1mbgs. Two soil samples per bore to be selected for analysis. Sample locations shown on <i>Figure 2, Appendix A</i> .
BH_SB09 – BH_SB10	2	4 x PFAS extended suite 2 x TOP Assay (samples selected after PFAS results) 1 x TOF 2 x ASLP PFAS	Delineate PFAS impact in soil around the workshop area source zone. Samples to be collected in the area to the north and south of BH_SB05 location. Soil bores are to be advanced to up to 1mbgs. Two soil samples per bore to be selected for analysis. Sample locations shown on <i>Figure 2, Appendix A</i> .
Total No. Soil Samples (including duplicates)		Soil Bores - 10 x PFAS extended suite, 3 x TOP Assay, 2 x TOF, 4 x ASLP PFAS	

Location ID	Number of Samples	Analytical Suite	Rationale
Total No. Rinsates / Blanks		1 x Rinsates (PFAS extended suite, super ultra-trace LOR) 1 x trip blanks (PFAS short suite – (super ultra-trace))	

5.1.1.1 Soil Sampling Methodology

Soil samples will be collected and logged in accordance with ERM Standard Operating Procedures (SOPs), with regard to the PFAS NEMP (2020) advice on sample collection for PFAS testing. In summary, the following work procedures will be followed:

- The soil strata will be logged by appropriately trained and experienced environmental scientist/engineer in general accordance with AS 1726 -1993;
- Soil samples will be collected from hand augured soil bores at depths of 0.25mbgs, 0.5mbgs and 1.0mbgs where possible;
- Two soil samples will be selected from each soil bore for laboratory analysis, with the remaining samples placed on-hold. Upon receipt of the results, if required, additional samples will be analysed for the same parameters to further delineate vertically PFAS in soil;
- Suitable personal protective equipment (PPE) including fresh disposable nitrile gloves will be used during sampling and equipment decontamination;
- The equipment that is in contact with soil will be decontaminated between soil bore depth intervals firstly by removal of loose soil by brushing. The auger will then be decontaminated between soil bores by scrubbing with a cleaning solution (Alconox and water) and rinsing with tap water followed by PFAS-free de-ionised water supplied by the laboratory;
- Representative soil samples will be collected in accordance with techniques described in ASC NEPM and the PFAS NEMP to maintain the representativeness and integrity of the samples and limit the potential for cross-contamination between samples or from external sources;
- The samples will be placed in laboratory-supplied HDPE sample containers. The containers will be completely filled, where practical, to minimise headspace, before being sealed and appropriately labelled;
- Field quality control/quality assurance (QA/QC) samples will be collected, including intra- and inter-laboratory duplicates (at a rate of one in ten samples), rinsate blanks and trip blanks;
- Sample jars will be immediately placed in a cooler on double-bagged ice to limit the risk of introduction of contamination from external sources for the duration of shipment under Chain of Custody (COC) documentation to the relevant laboratory; and
- Cuttings from each soil bore will be compacted back into the hole.

5.1.2 Sediment Sampling

Where characterisation of Stage 1 DSI sediment samples indicates exceedances of the trigger values, additional sediment samples will be collected for the characterisation of the source of the PFAS impact. Sediment at the outflow channel of Lake Gasteen near RP3 may be sampled multiple times to establish if temporal variability occurs.

5.1.3 Concrete Sampling

The objective of the concrete sampling was to assess whether PFAS is present as a secondary / ongoing source, and whether it may be mobilised via surface run-off and/or via leaching and vertical migration (to soil and/or groundwater).

Samples from the western (CON 01) and eastern (CON 02) workshop aprons (upper and lower at each) were collected and analysed for PFAS compounds. two selected samples (BH_CON01-U and BH_CON 02-L) were further analysed for TOP Assay and ASLP. The TOP Assay indicated the

presence of precursors in BH_CON01-U and the ASLP test indicated that this is a potential ongoing source of PFOS exceeding the PFAS NEMP 99% ecological guideline. The concrete aprons are well within the site boundaries and surface water in contact with the concrete will then have to flow across bare soil in order to reach on-site receptors. The concrete results will be taken into consideration should some form of PFAS mitigation be recommended by the DSI report.

It is not proposed to further sample the concrete aprons in the Stage 2 DSI works.

5.1.4 Surface Water Sampling

Surface water sample locations have been selected to fill data gaps (where no samples have previously been obtained), or to confirm previous surface water sample results. Where an exceedance of guideline values was found close to a site boundary, an off-site sample may be collected for verification of surface water. One proposed surface water sample, BH_SW16, was unable to be collected during the Stage 1 DSI due to being dry, this location will be revisited and if water is present, sampled. Proposed surface water locations are shown on *Figures 2-3, Appendix A*.

Three pit water samples were intended to be collected during the Stage 1 DSI; however, one selected location does not contain pit water. A second pit water sample BH_PW02, was unable to be collected due to operational reasons. In order to address the potential minimal PFAS sources from recorded safety incidents that may have involved AFFF use, the collection of samples from areas not previously sampled will be attempted. Pit water samples (PW) have only been added where no other surface water samples provide coverage for the incident locations.

Survey data (to be obtained from Batchfire mine planners and surveyors) for surface water bodies (including the creeks sampled and the dams on site), including invert levels (elevation of the base of creeks and dams) will be reviewed and compared to the depths of groundwater strike encountered during drilling new groundwater monitoring bores. This information will also contribute to the assessment of surface water / groundwater interaction and whether surface water bodies are 'losing' or 'gaining'.

The NEMP states that the performance of TOP Assay on water samples will be masked where the sum of Perfluoroalkyl Acids (PFAA) precursors divided by the sum PFAS <5%. The TOF analysis detects fluoro-organic compounds not readily detected by the standard PFAS analysis technique and provides a quantitative assessment, with a single cumulative parameter reported as the total PFAS concentration. Where a sample result is reported at close to a guideline value, TOF analysis may assist in the determination of a true PFAS concentration and therefore a guideline exceedance.

Samples selected from strategic areas such as site water discharge points, will be subjected to TOF analysis.

The sampling rationale is outlined in Table 5-2 below.

Table 5-2: Surface Water Investigation Locations, Analysis, and Rationale

Location ID	Number of Samples	Analytical Suite	Rationale
BH_SW16	1	1 x PFAS extended suite (super ultra-trace) 1 x Major ions and TDS	Targeting surface water draining from mine areas north of the former FTA. This sample was unable to be collected due to lack of flow during the Stage 1 DSI. Sample location shown on <i>Figure 2, Appendix A</i> .
BH_SW20	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP assay 1 x Major ions and TDS	Targeting the outflow/discharge point (RP3) from Lake Gasteen prior to surface water leaving the site. Confirmation of previous results. Sample location shown on <i>Figure 2, Appendix A</i> .

Location ID	Number of Samples	Analytical Suite	Rationale
BH_SW21	1	1 x PFAS extended suite (super ultra-trace) 1 x Major ions and TDS 1 x TOF	Targeting Gate Creek dam inside the southern boundary of the Mining Lease, south of Lake Gasteen. Confirmation the previous result (BH_SW17). Sample location shown on <i>Figure 2, Appendix A</i> .
BH_SW22	3	3 x PFAS extended suite (super ultra-trace) 1 x TOP assay 1 x Major ions and TDS	Confirmation of presence of PFAS in surface water downstream of previous Gate Creek dam sample BH_SW17. This dam receives runoff from the former Lake Gasteen/Gate Creek. Sample location shown on <i>Figure 2, Appendix A</i> .
BH_PW02	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay	Pit water samples (as shown on <i>Figure 3, Appendix A</i>) to represent potential run-off in catchments where safety incidents potentially involving AFFF use occurred. These samples will only be taken if there is safe access to the pit as mining operations and rainfall can prohibit access.
Total No. Surface Water Samples (including duplicates)		Surface Water: 7 x PFAS extended suite (super ultra-trace), 3 x TOP Assay (low level), 1 x TOF assay and 4 x major ions and TDS Pit Water: 1 x PFAS extended suites (super ultra-trace), 1 x TOP Assay (low level)	
Total No. Rinsates / Blanks		2 x Rinsates (PFAS extended suite, super ultra-trace LOR) 1 x trip blank (PFAS short suite (super ultra-trace))	

5.1.4.1 Surface Water Sampling Methodology

Where available, dam 'as built' drawings and invert levels will be reviewed prior to the sampling event. Batchfire's survey and topographical maps will also be reviewed for data relating to the site drainage lines and dam invert levels. Surface water bodies must be approached with care and therefore the sampling location is limited to the reach of the extendable pole from a safe position on the bank of the water body. ERM proposes the following methodology, consistent with the Stage 1 DSI, for the collection of surface water samples:

- Samples will be collected using a laboratory-supplied PFAS suitable sample container on the end of an extendable pole in order to obtain a sample up to 1m from the shoreline where possible;
- The sample container mounted on the pole will be immersed below the surface of the water to avoid, as much as possible, entraining any materials floating on the surface of the water;
- Sample containers (HDPE, provided by the analytical laboratory) will be completely filled to minimise headspace, before being sealed and appropriately labelled. Sample containers will be placed in a cooler on double-bagged ice immediately to minimise potential for introduction of external contaminants to samples during shipment under COC documentation to the laboratory;
- Non-dedicated sampling equipment will be decontaminated prior to sampling at each location, by washing with tap water mixed with Alconox and rinsing with tap water followed by PFAS-free de-ionised water provided by the laboratory; and
- Field parameters (when stabilised, as per the guidance outlined in Table 5-4, below) will be logged by lowering the water quality probe into the water body up to 1m from the shoreline after the collection of the sample to avoid the potential for cross contamination. The probe set will be washed with a mixture of tap water and Alconox, then rinsed with tap water followed by PFAS-free de-ionised water after each use.

5.1.5 Groundwater Sampling

Four new groundwater bores (BH_MB01, BH_MB02, BH_MB03 and BH_MB05), targeting the uppermost aquifer, have been installed at the Boundary Hill mine site during the Stage 1 DSI to assess the potential for PFAS impact in shallow groundwater. A fifth new groundwater monitoring bore (BH_MB04) was dry and the location was abandoned. Data will also be obtained to support the assessment of potential groundwater / surface water interactions and any migration pathways between shallow and deep aquifers.

Three existing groundwater bores (BH01, MB08 and MB28) that have been previously sampled will also be included in the groundwater sampling program. These bores target the deeper aquifer. The rationale for sampling existing bores and the installation of new bores is included in Table 5-3 below. The groundwater sampling methodology is described in Section 5.1.5.1 below. Consideration will be given to selecting bores for the fitment of data loggers in order to provide information on surface water / groundwater interactions.

Surface water and groundwater samples obtained from proximal locations will be analysed for major ions and Total Dissolved Solids (TDS) in order to enable comparison of chemistry between groundwater and surface water and assess the potential for interaction. This will also be supported by high precision height surveys of the bores and the installation of height datum reference markers at the surface water bodies. Recovery tests following bore purging will also be used for measuring the transmissivity of the aquifer in order to estimate the groundwater flow rate.

Corrected groundwater levels (relative to metres above Australian Height Datum (mAHD)) in shallow monitoring bores will be assessed in order to estimate groundwater flow directions.

The new and existing hydrogeological information, including survey data, slug tests, temporal groundwater chemistry data, as well as accessing Batchfire's geological model for the site, will be used to develop a conceptual site hydrogeological model. This will be used to inform groundwater flow regimes, surface water interactions and any migration pathways between shallow and deep aquifers. The Stage 1 DSI results and the development of the conceptual model are sufficient for the purposes of defining the site hydrological regime and additional groundwater bores are not deemed necessary during the Stage 2 DSI works.

Table 5-3: Groundwater Investigation Locations, Analysis, and Rationale

Location ID	Number of Samples	Analytical Suite	Rationale
BH01	1	1 x PFAS extended suite (super ultra-trace) 1 x major ions and TDS	Reconfirm / obtain seasonal data for BH01, south-west of the former FTA. Major ions and TDS data will be compared to data from nearby surface water sampling locations.
MB08	1	1 x PFAS extended suite (super ultra-trace) 1 x major ions and TDS	Reconfirm / obtain seasonal data for MB08, north of Lake Gasteen. Major ions and TDS data will be compared to data from nearby surface water sampling locations.
MB28	1	1 x PFAS extended suite (super ultra-trace)	Reconfirm / obtain seasonal data for MB28, adjacent Gate Creek, south of the Mining Lease southern boundary.
BH_MB01	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level) 1 x major ions and TDS	Targeting shallow groundwater south of Lake Gasteen, adjacent to Gate Creek below the dam wall. Major ions and TDS data will be compared to data from nearby surface water sampling locations.
BH_MB02	3	3 x PFAS extended suite (super ultra-trace)	Targeting shallow groundwater south-west of the MIA (where AFFF was historically

Location ID	Number of Samples	Analytical Suite	Rationale
	(1 primary, 1 intra-lab & 1 inter-lab duplicate)	1 x TOP Assay (low level) 1 x major ions and TDS 1 x TOF	changed out of mine vehicles), between the MIA and Lake Gasteen, and to establish shallow groundwater flow direction. Major ions and TDS data will be compared to data from nearby surface water sampling locations.
BH_MB03	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level) 1 x major ions and TDS	Targeting shallow groundwater south-east of the MIA (where AFFF was historically changed out of mine vehicles) and to establish shallow groundwater flow direction. Major ions and TDS data will be compared to data from nearby surface water sampling locations.
BH_MB05	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level) 1 x major ions and TDS 1 x TOF	Targeting shallow groundwater at the former FTA, and to establish shallow groundwater flow direction. Major ions and TDS data will be compared to data from nearby surface water sampling locations.
<i>Total No. Groundwater Samples (including duplicates)</i>		<i>9 x PFAS extended suite (super ultra-trace LOR), 4 x TOP Assay, 2 x TOF and 6 x major ions and TDS</i>	
<i>Total No. Rinsates / Blanks</i>		<i>2 x Rinsates (PFAS extended suite (super ultra-trace LOR)) 1 x trip blank (PFAS short suite (super ultra-trace))</i>	

5.1.5.1 Groundwater Sampling Methodology

Some bores have a SWL too great for the use of a peristaltic pump. ERM proposes to use Hydrasleeve samplers to collect representative groundwater samples, noting that Hydrasleeves are supported as a sampling method in the PFAS NEMP. Hydrasleeves are a no-purge system that allows for the sample bag to be set in place over long time frames (3-6 months) between sampling events. The sites groundwater monitoring bores are constructed with bentonite seals above the filter pack to prevent surface water inflows via the drilled soil bore and are fitted with well caps to prevent rainwater ingress.

Hydrasleeve components are inert and do not contain PFAS materials, thus not introducing contaminants into the groundwater to be sampled. The long deployment time between sampling events ensures that fresh groundwater will flow through the well between sampling events and provide fresh, representative, groundwater samples. The Hydrasleeve sample bag is fitted with a self-closing valve at the top that excludes further collection of water once the bag is full, excluding the collection of any stale water in the standpipe of the well. The bag fills as it is drawn upward through the water within the screened section of the well, where groundwater crossflow is expected to occur.

The following methodology will be employed for the collection of groundwater samples:

- Each bore will be gauged to Standing Water Level (SWL) using an interface probe prior to sampling. The total depth will be gauged after removal of the Hydrasleeve;
- HDPE Hydrasleeves have been selected as the most appropriate method for the on-going PFAS sampling of the sites groundwater bores as this method eliminates the potential for cross contamination when using a submersible pump. Hydrasleeve equipment other than the sample bag itself will be dedicated to the individual monitoring bore. The sample bag is discarded and replaced at each sampling event. HDPE Hydrasleeves will be set and left to equilibrate for at least two days prior to sampling;
- HDPE Hydrasleeves will be installed in approximately the centre of the screened section of each well, where possible, so that the groundwater sample is collected from the screened section of the well where flow through of groundwater is expected;

- Samples obtained from Hydrasleeves will be placed directly into laboratory-supplied sample bottles, the bottles will be placed in eskies with double bagged ice for preservation;
- Field parameters (pH, electrical conductivity, oxidation-reduction potential, temperature and dissolved oxygen) will be measured using a calibrated water quality meter and a static cell filled from a portion of the sample obtained from the Hydrasleeve. The indicative stabilisation criteria are as described in Table 5-4 below;
- One primary sample will be collected per well, with intra-laboratory and inter-laboratory duplicate samples to be obtained at a rate of one per ten primary samples;
- Sample containers (HDPE, provided by the analytical laboratory) will be completely filled to minimise headspace, before being sealed and appropriately labelled. Sample containers will be placed in a cooler on double-bagged ice immediately to minimise potential for introduction of external contaminants to samples during shipment under COC documentation to the laboratory; and
- Non-dedicated sampling equipment (e.g., the interface probe) will be decontaminated prior to sampling each well, washing with tap water mixed with Alconox and rinsing with tap water followed by PFAS-free de-ionised water provided by the laboratory.

Table 5-4: Water Quality Parameter Stabilisation Criteria

Parameter	Indicative Stabilisation criteria
pH	± 0.1 pH units
Electric Conductivity (EC)	± 3% μ S/cm
Temperature	± 0.5°C
Oxidation Reduction Potential (ORP)	± 10 mV
Dissolved Oxygen (DO)	± 0.3 mg/L

It is noted that both ORP and DO are typically slower to stabilise than the other parameters, and may be particularly unstable when not using a closed flow through cell. In this case, greater weight will be given to pH and EC as the 'stabilising' parameters. Temperature should be recorded immediately as the temperature of the water in a static cell will be affected by the length of time it is exposed to the ambient temperature.

5.2 Stage 2 DSI

Where potential pathways are present within the updated CSM, or if insufficient data has been collected to determine if a pathway is complete or not, supplementary sampling may be required (Stage 2 DSI). Supplementary sampling identified includes:

- Surface water and sediment sampling of distant receiving water bodies (subject to landholder property access), including those downgradient of on-site flow paths where PFAS has been detected and off-site areas irrigated with beneficial reuse water;
- Soil sampling will be conducted in additional areas to assess the potential soil contamination away from the workshop area;
- Biota sampling of water bodies, on-site and off-site (subject to landholder property access);
- Additional seasonal gauging of surface water and groundwater levels; and/or
- Seepage monitoring of on-site dams.

5.2.1 Biota Sampling

The scope of the biota sampling program will be developed based on the findings of Stage 2 of the DSI. While it is premature to detail the exact scope of biota sampling required at this stage of the

Work Plan, a biota sampling program for an area that includes an aquatic ecosystem and human recreational water users would be developed based on the understanding of aquatic ecosystem food web and an assessment of the diet of key species. A review of key recreationally caught aquatic species would also be taken into account.

Following the development of the site-specific foodweb, target organisms may be selected for sampling where an SPR linkage is identified as potentially being complete.

An assessment of edible portions will be used in estimating the risks of exceeding the tolerable daily intake with reference to the Queensland Health Guideline and portion sizes recommended by Food Standards of Australia and New Zealand.

5.2.1.1 Biota Sampling Methodology

In order to update this Work Plan with a technically defensible sampling scope for biota, a food web will be developed in order to identify the number and type of species to target. The aim of the biota sampling (if required) will be to assess potential impacts to aquatic ecosystems, the potential for bioaccumulation, and potential impacts to human health via consumption.

After identifying the target species, the next step will be the determination of the correct timing of sampling events for the efficient collection of representative target species. State Government and Local Government permitting requirements will be reviewed during the planning stages and complied with during sampling, accordingly. Finally, appropriate trapping/collection methods and the physical preservation and transport of trapped biota for laboratory analysis will be identified to ensure that specimens arrive at the laboratory for analysis under COC conditions with minimal risk of degradation or cross contamination during transportation.

5.3 Investigation Derived Waste

Investigation-derived waste generated during the Stage 2 DSI will comprise soil from the shallow soil bores, nitrile gloves and other packing and single-use materials (plastic wraps, bottles, etc) generated during sampling activities. Soil is to be placed back into the soil bores and compacted in place; no waste soil is expected to be generated. Used nitrile gloves, cardboard containers, plastic wrap, empty water bottles and other general waste materials will also be double-bagged and secured as required.

Groundwater removed in excess of the required sample volume will be decanted to a storage container and transported to the MIA. An IBC has been placed at a central location (within the waste collection area) of the Boundary Hill MIA to store potentially impacted purged groundwater for later disposal.

6. LABORATORY ANALYSIS

The primary analytical laboratory selected for soil, sediment, surface water, groundwater and biota sample analysis is Australian Laboratory Services (ALS). The secondary analytical laboratory selected is Eurofins Laboratories (Eurofins). Both laboratories are accredited by the National Association of Testing Authorities (NATA) for the analytical suites proposed.

NATA laboratories carry out internal QA/QC testing and report these results. These include matrix spikes to gauge recovery and matrix interference, duplicate samples split from a primary sample for comparison, method blanks and surrogate recovery. For the analysis of PFAS TOP assay, the laboratory will carry out quality assurance checks to ensure that oxidant exhaustion has not occurred. ERM will review the laboratory results to confirm this and may request the laboratory to re-run some samples, if warranted.

6.1 Quality Assurance and Quality Control

Reusable sampling equipment will be avoided where possible, to limit the risk of cross-contamination. However, where equipment (such as the interface probe for gauging groundwater levels) is required

to be decontaminated between uses, Alconox (which is PFAS-free) will be used, followed by rinsing with tap water followed by laboratory-supplied, certified PFAS-free deionised water. Where there is any doubt about whether or not materials or personnel are PFAS-free, or if there is any uncertainty arising regarding the potential for cross-contamination, rinsate samples will be collected.

QA/QC field sampling will include:

- The collection of replicate QA samples at a rate of one set per ten primary samples of each media, with the secondary replicate samples sent for analysis at a secondary NATA accredited laboratory;
- The collection of Rinsate samples at a rate of at least one per day of sampling from cleaned, reusable equipment; and
- The placement of field trip blanks into each esky to confirm a lack of cross contamination has occurred during storage and transit.

Other PFAS-specific considerations and procedures that will be followed include the following:

- Sample locations with known or suspected elevated concentrations of PFAS will be sampled last, to limit the chance of sample cross contamination;
- All sample containers (to be provided by the selected laboratories) and consumable equipment (such as tubing for groundwater sampling) are to be polypropylene or high-density polyethylene;
- No food wrappers, sticky notes, stain- or water-resistant clothing, reusable freezer blocks will be used during any stage of the sampling; and
- No sunscreen or insect repellent will be worn or used during any stage of sampling unless certified as PFAS free.

7. REPORTING

7.1 DSI Report (CLID)

A DSI report (Requirement 7 of the EEN) will be prepared, detailing the findings of the sampling and analysis quality plan (both Stage 1 and Stage 2 of the DSI, as applicable) to determine the nature and extent of PFAS impact arising from any direct or indirect release of AFFF. The report will be prepared by a Suitably Qualified Person (SQP) but notes that DES has acknowledged (Environmental Evaluation E-100078550 – Requirement 5 – SAQP Workplan – Clarification, dated 19 May 2022) that the scope of the DSI is limited to PFAS (and no other hazardous contaminants), and therefore the content requirements of a CLID may not be met. Under these circumstances, clause 8 of the EEN may not be able to be satisfied, as the EP Act does not allow the scope of a CLID to be limited. The Auditor's review of the DSI report will be conducted on this basis.

7.2 Final Environmental Report

Following submission of the Auditor certified DSI to DES, a video conference will be scheduled to present the findings and facilitate any final discussions.

Following this discussion, a Final Environmental Report (Requirement 10 of the EEN) will be prepared. This report will comprise a brief document presenting statements that demonstrate that all requirements of the EEN have been met.

8. REFERENCES

Australian Department of Health (2017). *Health-Based Guidance Values for PFAS for Use in Site Investigations in Australia—Recreational Water Quality Value*.

Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2023 (ANZG 2023, Toxicant default guideline values for aquatic ecosystem protection: Perfluorooctane sulfonate (PFOS) in freshwater;

Australian Department of Health (2019). *Australian Drinking Water Quality Value Guidelines*.

Australian Government (2012) National Water Commission: *Minimum Construction Requirements For Water Bores In Australia, Third Edition, February 2012*.

Epic Environmental (2022). CS Energy Limited *PFAS Investigation – Hydrological Review, Callide Power Station, BC200153.04, 4 April 2022*.

NHMRC (2019). *Guidance on Per and Polyfluoroalkyl Substances (PFAS) in Recreational Water*.

ANZG (2018). *Australia and New Zealand Guidelines for Fresh and Marine Water Quality*.

DES (2009). *Queensland Water Quality Guidelines*.

DES (2010) *Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009 Version 2*. September 2010.

DES (2019). *Environmental Protection (Water and Wetland Biodiversity) Policy*.

ERM (2022). *Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland; Boundary Hill Site Per – and Poly-Fluoroalkyl Substances Preliminary Site Investigation (2021-2022) Project No: 0602830-02, 28 April 2022*

Food Standards Australia and New Zealand (FSANZ) Available on-line at:
<https://www.foodstandards.gov.au/science/monitoringnutrients/ausnut/assigningfood/Pages/assigningportions.aspx>

HEPA (2020). *PFAS National Environmental Management Plan (NEMP) Version 2.0*. January 2020.

NEPC. 1999, amended 2013. *National Environment Protection (Assessment of Site Contamination) Measure*.

NHMRC (2019). *Guidance on Per- and Polyfluoroalkyl Substances in Recreational Water*.

Queensland Government. 1994. *Environmental Protection Act*.

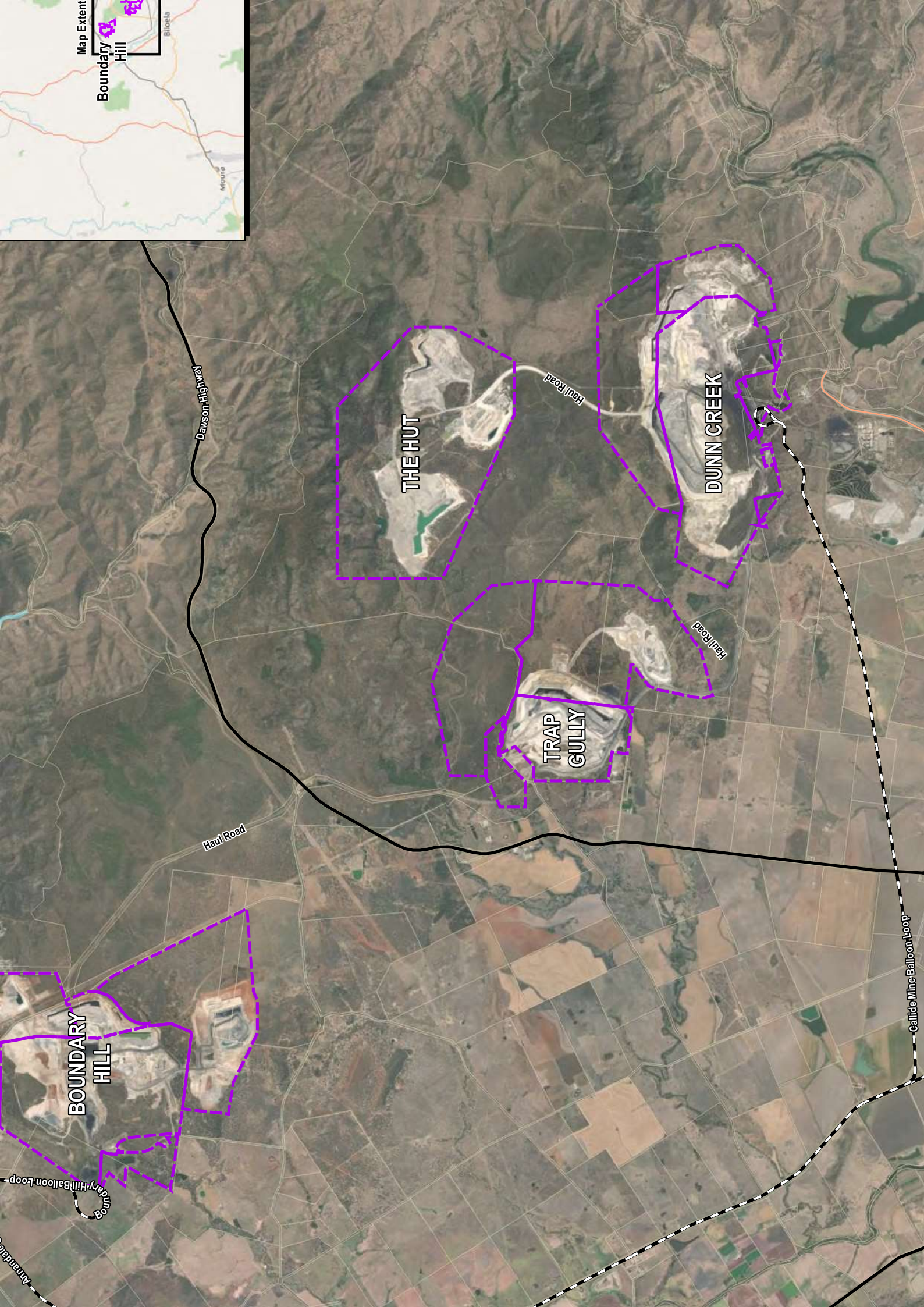
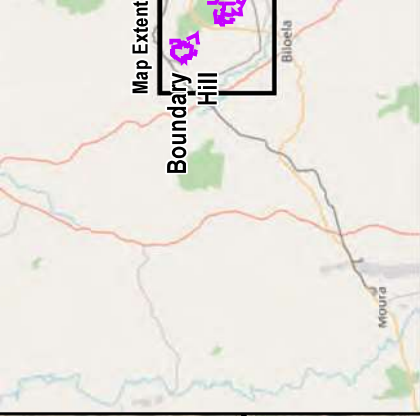
Queensland Health Guidance, *Guideline for the sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination*.

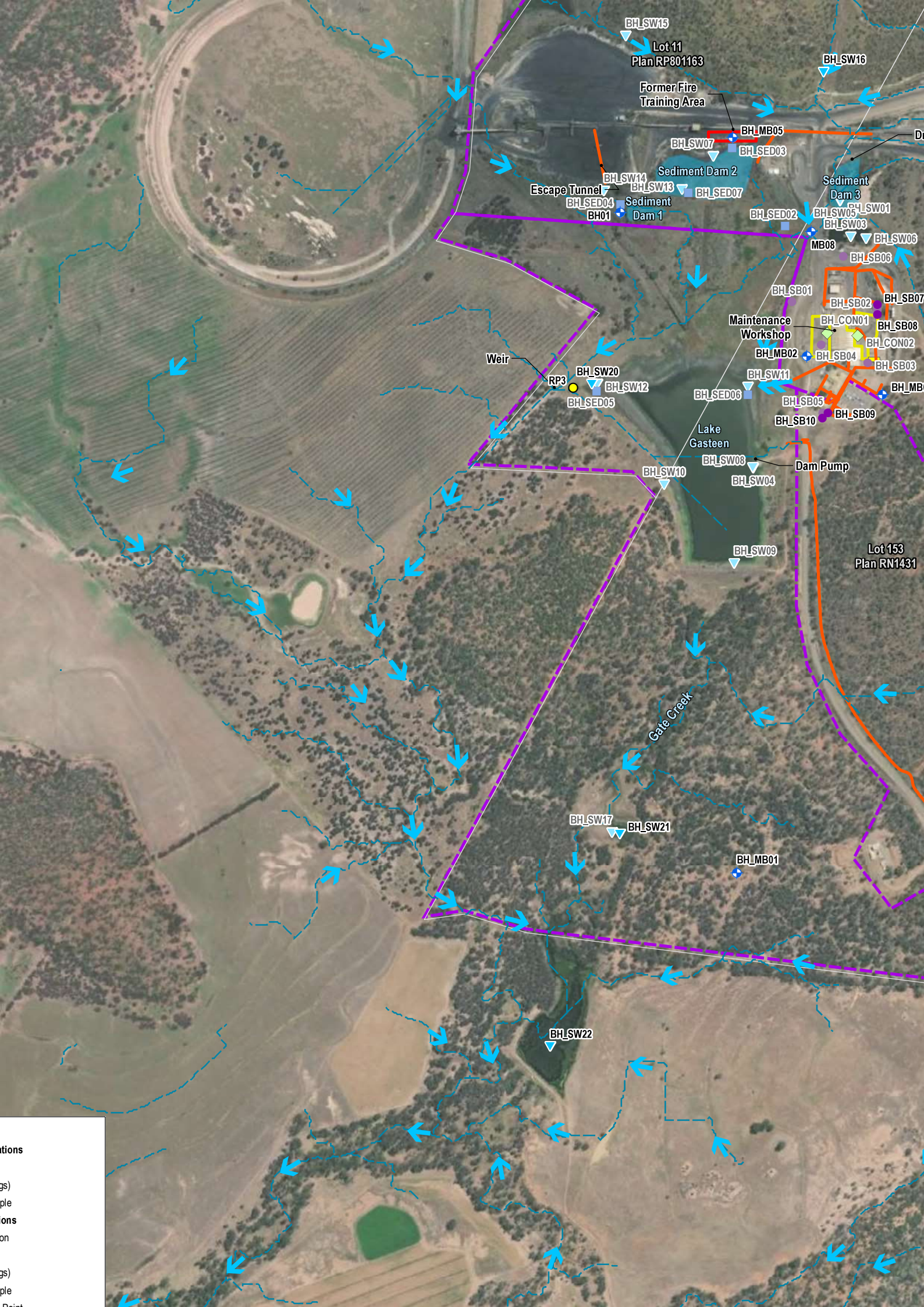
9. IMPORTANT LIMITATIONS AND CONTEXT

1. This report is based solely on the scope of work described in Batchfire PFAS Project Site Specific E2E Strategy Plan (ERM, 4 February 2022) (**Scope of Work**) and performed by ERM Australia Pacific Pty Ltd (**ERM**) for Batchfire Callide Management Pty Ltd (the **Client**). The Scope of Work was governed by a contract between ERM and the Client (**Contract**).
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between 2 May 2022 and 12 September 2023 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.
5. Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.
6. This report is based on one or more site inspections conducted by ERM personnel, the sampling and analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:
 - a. did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
 - b. assumes no responsibility or liability for errors in data obtained from,the Client, any third parties or external sources (including regulatory agencies).
7. Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.
8. Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:
 - a. the suitability of the site(s) for any purpose or the permissibility of any use;
 - b. the presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
 - c. the presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).
9. Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.

10. The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.
11. This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.
12. Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:
 - a. has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
 - b. does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
 - c. does not purport to provide, nor should be construed as, legal advice.

APPENDIX A FIGURES





ations

gs)

ple

ons

on

gs)

ple

Point



**ERM has over 160 offices across the following
countries and territories worldwide**

Argentina	The Netherlands
Australia	New Zealand
Belgium	Peru
Brazil	Poland
Canada	Portugal
China	Puerto Rico
Colombia	Romania
France	Russia
Germany	Senegal
Ghana	Singapore
Guyana	South Africa
Hong Kong	South Korea
India	Spain
Indonesia	Switzerland
Ireland	Taiwan
Italy	Tanzania
Japan	Thailand
Kazakhstan	UAE
Kenya	UK
Malaysia	US
Mexico	Vietnam
Mozambique	

ERM's Brisbane Office

Level 9
260 Queen St,
Brisbane QLD 4000

T: (07) 3839 8393

F: (07) 3839 8381

www.erm.com



Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland

Callide Mine Site Per- and Poly-Fluoroalkyl
Substances Stage 2 Detailed Site
Investigation 2023 Work Plan

15 September 2023

Project No.: 0637703I-02

Document details	
Document title	Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland
Document subtitle	Callide Mine Site Per- and Poly-Fluoroalkyl Substances Stage 2 Detailed Site Investigation 2023 Work Plan
Project No.	0637703I-02
Date	15 September 2023
Version	5.0
Author	Ross Lawrence, Patrick Mason, Ken Kiefer, Emily Chen
Client Name	Batchfire Callide Management Pty Ltd

Document history

Version	Revision	Author	Reviewed by	ERM approval to issue		Comments
				Partner In Charge	Date	
Draft	1.0	Ross Lawrence Patrick Mason Ken Kiefer, Emily Chen	Ken Kiefer Ross Lawrence	Neil Donaldson	03.04.2023	2023 Update to Work Plan R1 Draft for client and Auditor review
Draft	2.0	Patrick Mason Ken Kiefer, Emily Chen	Ken Kiefer	Chris Gimber	18.04.2023	Incorporate Client comments
Draft	3.0	Patrick Mason Ken Kiefer, Emily Chen	Ken Kiefer Ross Lawrence	Chris Gimber	08.05.2023	Incorporate Client comments
Draft	4.0	Patrick Mason, Ross Lawrence, Ken Kiefer, Emily Chen	Ken Kiefer	Chris Gimber	28.07.2023	Incorporate CLA Comments
Final	5.0	Ross Lawrence	Ken Kiefer	Chris Gimber	15.09.2023	Incorporate CLA comments

Signature Page

15 September 2023

Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland

Callide Mine Site Per- and Poly-Fluoroalkyl Substances Stage 2 Detailed Site Investigation 2023 Work Plan

Ross Lawrence
Senior Environmental Scientist

Patrick Mason
Project Manager

Ken Kiefer
Technical Director

Chris Gimber
Partner

ERM Australia Pacific Pty Ltd
Level 14 207 Kent Street
Sydney NSW 2000

© Copyright 2023 by The ERM International Group Limited and/or its affiliates ('ERM').
All Rights Reserved. No part of this work may be reproduced or transmitted in any form
or by any means, without prior written permission of ERM.

CONTENTS

1.	INTRODUCTION	1
1.1	Overarching Strategy	1
1.2	Background	1
1.3	Objectives	3
2.	SITE DESCRIPTION	4
3.	REGULATIONS, POLICIES AND MEASURES	5
3.1	Adopted Criteria	5
3.1.1	Soil and Sediment Samples	5
3.1.2	Concrete Samples	6
3.1.3	Surface Water Samples	6
3.1.4	Groundwater Samples	8
3.1.5	Biota Samples	8
4.	DATA QUALITY OBJECTIVES	9
4.1	Step 1: State the Problem	10
4.2	Step 2: Identify the Decisions	10
4.3	Step 3: Identify Inputs to the Decisions	10
4.4	Step 4: Define the Study Boundaries	11
4.5	Step 5: Develop a Decision Rule	11
4.6	Step 6: Specify the Performance or Acceptance Criteria	12
4.7	Step 7: Optimise the Design for Obtaining Data	12
5.	PROPOSED SCOPE OF WORK AND METHODOLOGY	13
5.1	Stage 2 DSI	13
5.1.1	Soil Sampling	16
5.1.2	Sediment Sampling	18
5.1.3	Concrete Sampling	18
5.1.4	Surface Water Sampling	18
5.1.5	Groundwater Sampling	22
5.1.6	Landholder Beneficial Water Use Sampling Plan and Human Health and Ecological Risk Assessment	25
5.2	Proposed Properties and Sampling Schedule	29
5.3	Investigation Derived Waste	34
6.	LABORATORY ANALYSIS	34
6.1	Quality Assurance and Quality Control	35
7.	REPORTING	36
7.1	DSI Report (CLID)	36
7.2	Final Environmental Report	36
8.	REFERENCES	37
9.	IMPORTANT LIMITATIONS AND CONTEXT	38

APPENDIX A FIGURES

List of Tables

Table 2-1: Site Identification.....	4
Table 3-1: Summary of Surface Water EVs and Adopted Criteria.....	7
Table 3-2: Summary of Groundwater EVs and Adopted Criteria.....	8
Table 4-1: Decision Rules.....	11
Table 5-1: Soil Investigation Locations, Analysis, and Rationale	16
Table 5-2: Surface Water & Beneficial use Water Investigation Locations, Analysis, and Rationale...	19
Table 5-3: Groundwater Investigation Locations, Analysis, and Rationale	22
Table 5-4: Water Quality Parameter Stabilisation Criteria	24
Table 5-5: Identified Beneficial Uses of Mine-Derived Water (by February 2023)	27
Table 5-6: Proposed Properties to be Assessed and Associated SAP	29

List of Figures

Figure 1 – Callide Mine Site Locations

Figure 2a – Sampling Locations – Callide Southern Operations

Figure 2b – Sampling Locations – Dunn Creek Pit

Figure 3 – Sampling Locations – Trap Gully

Figure 4 – Sampling Locations – The Hut

Figure 5 – Beneficial Reuse Water Sampling Locations

Acronyms and Abbreviations

Name	Description
AFFF	Aqueous Film Forming Foam
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure
Batchfire	Batchfire Callide Management Pty Ltd
CLA	Contaminated Land Auditor
CSM	Conceptual Site Model
DES	Queensland Department of Environment and Science
ERM	ERM Australia Pacific Pty Ltd
EV	Environmental Value
FTA	Fire Training Area
FtS	Fluorotelomer sulfonic acids (Fluorotelomers)
HDPE	High density polyethylene
LDPE	Low density polyethylene
LOR	Limit of Reporting
MIA	Mining Infrastructure Area
MSDS	Material Safety Data Sheet
PFAA	Perfluoroalkyl Acids
PFAS	Per- and Poly-Fluoroalkyl Substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
PFHxS	Perfluorohexanesulfonic acid
PFHxA	Perfluorohexanoic acid
PFAS NEMP	PFAS National Environmental Management Plan
PSI	Preliminary Site Investigation
QA/QC	Quality assurance / quality control
SPR	Source-Pathway-Receptor
SQP	Suitably Qualified Person
TOF	Total Organic Fluorine
TOPA	Total Oxidisable Precursor Assay
WQO	Water Quality Objective

1. INTRODUCTION

This Work Plan has been prepared as the second stage of works following an initial Detailed Site Investigation (DSI) by ERM Australia Pacific Pty Ltd (ERM) on behalf of Batchfire Callide Management Pty Ltd (Batchfire) to outline the strategy to assess Per- and Poly-fluoroalkyl Substances (PFAS) in environmental media at the Callide Mine Site Southern Operations area. Batchfire transitioned all fluorinated Aqueous Film Forming Foams (AFFF) to fluorine-free AFFF, in line with the Queensland Department of Environment and Science (DES) (2016) *Operational Policy – Environmental Management of Firefighting Foam* in 2019. As part of this process, Batchfire prepared a *Disposal Plan – Aqueous Film Forming Foam (AFFF)*, between June and November 2019, and commissioned ERM to undertake a voluntary PFAS Preliminary Site Investigation (PSI) at the site. However, during the course of this investigation, and based on discussions with DES, an Environmental Evaluation Notice (EEN) was issued on 16 December 2021 (DES reference: STAT-E-100078550).

Requirement 5 of the EEN includes development and submission of a Work Plan outlining the overall investigation strategy for the Detailed Site Investigation (DSI), including a Sampling and Analysis Quality Plan (SAQP). The EEN acknowledges that the work plan may be carried out over several stages, in order to obtain sufficient data to adequately evaluate the site. This Work Plan acknowledges that DES has agreed (Environmental Evaluation E-100078550 – Requirement 5 – SAQP Workplan – Clarification, dated 19 May 2022) that the scope of the DSI is limited to PFAS (and no other hazardous contaminants), and therefore the content requirements of a Contaminated Land Investigation Document (CLID) may not be met. Under these circumstances, clause 8 of the EEN may not be able to be satisfied, as the EP Act does not allow the scope of a CLID to be limited. The Auditor's review of the DSI report will be conducted on this basis.

1.1 Overarching Strategy

The overarching strategy is to develop a sampling scope of work that effectively evaluates the nature and extent of PFAS contamination that may have been caused by any direct or indirect releases from the site to soil, surface water, groundwater or sediments. To maximise the efficient and sustainable use of resources associated with the investigations, a staged approach is proposed, as follows:

Stage 1 – detailed soil, surface water, groundwater and sediment sampling targeting source areas identified in the PSI and addressing identified data gaps. This includes the installation of additional groundwater monitoring wells at selected locations, specifically targeting shallow groundwater in the vicinity of identified PFAS release points and downgradient flow paths; and

Stage 2 – Following review of the findings of Stage 1, additional data needs to be collected to further delineate the extent of impacts (vertically or laterally); or to provide additional lines of evidence to document any seasonal variability. Stage 2 sampling may also include biota sampling where the Stage 1 DSI sampling results indicate potentially complete Source-Pathway-Receptor (SPR) linkages exist. Now that the Stage 1 works have been carried out, the data gaps identified in the ERM document *Batchfire Callide Southern Mine – PFAS DSI Progress Update* are summarised below in Section 1.2 and 5.2. This revised work plan now details the Stage 2 sampling required to fill data gaps from the Stage 1 sampling activities and provide additional temporal data for seasonal conditions at the site.

1.2 Background

Historically, fluorinated AFFF (containing PFAS) has been used at the Callide Mine site, which is now operated by Batchfire (previously operated by Anglo American). PFAS has been released to ground as a result of fire systems maintenance, firefighting training and actual fire suppression events, where required. The *Callide Mine Site Per- and Poly-Fluoroalkyl Substances Preliminary Site Investigation (2021-2022)*, *Batchfire Callide Coal Mine, Coal Road, Biloela, Queensland* (ERM, 28 April 2022)

identified detectable concentrations of PFAS in soil, surface water and groundwater within the Callide Southern Operations area.

Based on the preliminary Conceptual Site Model (CSM), the potentially complete Source-Pathway-Receptor (SPR) linkages include:

Direct or indirect contact with PFAS-impacted shallow soils at the former Fire Training Area (FTA) for terrestrial ecosystems on-site;

Direct contact with PFOS and PFHxS impacted surface water (exceeding DoH 2019 drinking water values) for on-site workers (conducting drain or interceptor maintenance), noting that this risk can be managed by implementation of safety protocols. This has been identified only in surface water samples obtained from run-off / discharge downstream of the workshops; and

Exposure of freshwater aquatic ecosystems to PFOS and PFHxS in on-site or off-site surface water and/or groundwater, depending on surface water / groundwater interactions on-site. The potential off-site linkage is subject to overflow events from Dunn Creek Dam where concentrations of PFOS are unlikely to exceed the adopted criteria as a result of dilution factors, or via ephemeral drains south / south-west of the workshops.

The following data gaps were identified following the Stage 1 DSI fieldwork:

1. Groundwater flow direction – new groundwater bores need to be surveyed and geological maps reviewed to confirm which bores are screened across equivalent units. Given the varying geology encountered during drilling across the site, it is possible that there may not be sufficient information to estimate groundwater elevation contours and flow direction;
2. The actual volume of beneficial re-use water supplied from the mine site has been estimated but not precisely quantified. Water flow meters are currently only fitted to five off-takes. While additional water flow meters are being fitted, only limited data is expected to be available in the short term;
3. Beneficial reuse water pipeline – the presence of PFOS exceeding the PFAS NEMP 99% ecological value and at one location PFHxS + PFOS exceeding the NEMP drinking water guideline value has been detected. A full round of beneficial water sampling is to be carried out in the Stage 2 DSI, all five sampling points are to be accessed at this time with collection of additional samples to assess if there are any differences in PFAS concentrations when water flows in a northerly vs southerly direction. Collect samples from the two locations proposed to be sampled once access valves have been installed;
4. Given that concentrations of PFOS exceeded the PFAS NEMP 99% ecological value in all three of the beneficial reuse water samples, and concentrations of PFHxS+PFOS also exceeded the drinking water value, the specific uses of water by the receiving properties should be further explored, if required. Information about uses should be obtained by visiting each property and completing a brief questionnaire about uses (e.g., lawn watering, stock water (including domestic, such as chickens, with consumption of eggs), crop irrigation (including backyard fruit and vegetables for consumption). Based on this further understanding, off-site sampling (of shallow soils, surface run-off, and/or biota) may be required at selected properties;
5. No biota sampling has been carried out to assess the potential for bioaccumulation in on-site or off-site populations. Since the beneficial use water supplied to landowners has been found to be impacted, off site sampling is to be carried out in the Stage 2 DSI, commencing with surface water, soil and biomass sample collection. The landowner questionnaire will inform the selection of representative sampling sites;
6. Surface water seasonal flows – obtain surface water samples opportunistically during significant rainfall events, where run-off is observed originating from source zones (i.e., workshops and former fire training area), particularly at points of discharge (site boundaries);

7. Soil – the horizontal extent of PFAS impact in shallow soils to the south, west, north and east of the workshops has not been fully delineated. Samples of soil and sediment have been analysed for leachability. In most instances, soil and sediment samples were found to be highly leachable;
8. No surface water sample was able to be obtained at Magazine Dam given that it had been drained in preparation for desilting activities. The sediment sample (CM_SED09) obtained from the dam reported a minor detection of 6:2 FtS only. If possible, a surface water sample should be obtained during the wet season to characterise this dam;
9. Two of the proposed Trap Gully pit water samples were unable to be obtained, one due to current operational activities and one due to the pit being dry. Whilst it would be prudent to characterise these water bodies, it is not deemed critical to the project (and they are considered unlikely to be major contributors to the overall PFAS concentrations); and
10. Obtain a groundwater sample from monitoring bore CM_MB17 (south of Dunn Creek Dam) when Dunn Creek Dam water levels increase. When drilled, this bore did make water, but upon returning to sample groundwater, Dunn Creek Dam water levels had been dropped (as a water management measure, preceding the wet season) and this bore was dry. This suggests strong surface water / groundwater interaction at this location.

In order to meet Requirement 5 of the EEN, a Work Plan outlining the proposed approach to sampling and analysis for a DSI that focuses on filling the data gaps of the PSI and the preliminary CSM is required. The Stage 1 work plan has been completed; however, some data gaps remain to be addressed by this Stage 2 (revised Stage 1) work plan. The Sampling and Analysis Plan (SAP) is included in the work plan.

1.3 Objectives

The objectives of the DSI are to fully characterise the nature and extent of PFAS impact in environmental media associated with any direct or indirect releases of PFAS at the site, specifically focusing on addressing the data gaps identified in the PSI (outlined above).

Further, the DSI (in line with EEN Requirement 6 and Requirement 9) will seek to:

- a. Identify any and all pathways relevant to the migration of potentially impacted surface water or groundwater (addressing data gaps 1-2, 4-7 and 9 above);
- b. Assess the potential connectivity between groundwater and surface water (addressing data gaps 2, 4-7 above);
- c. Assess the potential for PFAS migration off-site from Dunn Creek Dam during heavy rainfall events (addressing data gap 3 above);
- d. If required, based on findings of Stage 1 of the DSI, assess PFAS concentrations in the edible portions of biota to estimate risks of exceeding tolerable daily intakes, as well as whole biota samples to evaluate bioaccumulation risk (addressing data gap 5 above);
- e. Assess samples of all environmental media for the presence of PFAS precursors (via Total Organic Fluorine (TOF) and Total Oxidisable Precursor (TOP) Assay analysis), addressing the requirements of the EEN; and
- f. Obtain data on grainsize fractions and organic carbon content in sediment samples to allow standardization when comparing data from different locations.

2. SITE DESCRIPTION

Site identification details are summarised in Table 2-1 below.

Table 2-1: Site Identification

Item	Description
Site Name	Batchfire Callide Coal Mine
Site Address	Coal Road, Mt Murchison, Qld
Property Identification	Lot 100 on SP301602 (Main site), Lot 31 on RN869, Lot 23 on SP129150, (Callide Mine Southern Operations), Lot 31 RP899131 and Lot 1 SP200919 (Trap Gully area), and Lot 170 FTY1843 (The Hut area)
Site Area	Approx. 56ha
Owner	Batchfire Callide Management Pty Ltd (comprising 66.7% Batchfire Callide Pty Ltd and 33.33% Batchfire Callide No 2 Pty Ltd)
Land Use Zoning	Mining (main site) and Infrastructure Designation (southern section of the rail loop)
Current Land Use	Mining

Site location and site features are presented in *Figures 1, 2a-2c and 3*, attached.

The site includes the Callide Southern Operations administration, warehouse and workshop area, known as the Mine Infrastructure Area (MIA). The MIA includes surface water drainage lines and dams to the north and south of the workshops, the former FTA and surrounding areas located to the south of the Dunn Creek mining pit, including Magazine Dam, Lake McCauley, the Rail Loop Pond, the Dunn Creek Dam and the East Dam. To the north of the MIA is The Hut mining area, which includes the Oaky Creek Dam (NV8). This dam was created during the diversion of Oaky Creek around The Hut mining area and associated pit (the CVN Pit).

Also included in the site is the Trap Gully mining area, consisting of dams in the vicinity of the laydown area, the Sediment Pond, Ghost Ryders Dam and Goldings Dam. The Trap Gully laydown area is located in an open area to the west of Ghost Ryders Dam.

The Spine Pipeline collects water from Callide Southern Operations dams (East Dam, Ghost Ryder's Dam and Dunn Creek Dam) and from Boundary Hill's Lake Gasteen. This pipeline supplies beneficial reuse water to a number of nearby landholders for irrigation and non-potable domestic uses.

3. REGULATIONS, POLICIES AND MEASURES

The investigation will be undertaken in reference to the following regulations, guidelines, and policy documents:

- *Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2018* (ANZG 2018);
- *Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2023* (ANZG 2023, *Toxicant default guideline values for aquatic ecosystem protection: Perfluorooctane sulfonate (PFOS) in freshwater*;
- *DES Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (DES 2019);
- *Department of Environment and Heritage Protection Queensland Water Quality Guidelines 2009* (DEHP 2009);
- *DES Monitoring and Sampling Manual: Environmental Protection (Water) Policy* (DES 2018);
- *Heads of EPAs Australia and New Zealand PFAS National Environmental Management Plan Version 2.0* (HEPA 2020);
- NHMRC, NRMCC (2011) *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*. National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra;
- *NEPC National Environment Protection (Assessment of Site Contamination) Measure 1999* (amended 2013) (Assessment of Site Contamination [ASC] NEPM); and
- *Queensland Government Environmental Protection Act* (1994).

3.1 Adopted Criteria

Adopting a risk-based approach as detailed in the national guidance (ASC NEPM), soil, sediment, surface water and groundwater results will be screened against established criteria drawn from PFAS NEMP guidance.

Where biota sampling is warranted, biota results will be screened against the criteria presented in the PFAS NEMP and with reference to the Queensland Health Guideline for the edible portions risk of exceeding the tolerable daily intake and the Food Standards Australia and New Zealand (FSANZ) for portion sizes. An evaluation of the bioaccumulation species risk will form part of this assessment.

Based on the current land use for mining, with agricultural and recreational uses in the surrounding areas, ERM proposes adopting the criteria outlined in the sections below.

3.1.1 Soil and Sediment Samples

The adopted soil and sediment criteria consider current zoning and land use of the site, the surrounding land use and potential contamination pathways. As such, the following criteria have been nominated for this investigation:

PFAS NEMP (2020) Human health (direct contact) values for industrial / commercial;

PFAS NEMP (2020) Human health (direct contact) values for public open space;

PFAS NEMP (2020) Interim ecological (direct contact) values for all land uses; and

PFAS NEMP (2020) Interim ecological (indirect exposure) values for all land uses.

As noted in the PFAS NEMP (HEPA, 2020), these interim soil guidelines lack consideration of transport and leaching of PFAS from soil or sediment into groundwater and surface water (whereby PFAS may be mobilised to off-site locations). A neutral rainwater simulation leach (Australian Standard Leaching Procedure (ASLP)) will be applied to selected soil and sediment samples. For assessment of the potential impacts on wildlife and aquatic biota and in conjunction with

environmental variability, the surface water criteria in Table 3-1 and groundwater criteria in Table 3-2 for the relevant environmental values will be applied to the ASLP results.

3.1.2 Concrete Samples

Concrete surfaces in workshops (one of the source zones identified in the PSI) may be impacted with PFAS, which may be acting as a secondary source (if PFAS leaches out of the concrete over time) and could result in impacted groundwater or stormwater runoff. Concrete samples will be treated in a similar manner to soil and sediment samples after laboratory processing. The following soil criteria have been nominated for the concrete investigation; however, criteria may need to be reviewed given the exposure mechanisms between soil or sediment and concrete are not equivalent (i.e., the risk of exposure to PFAS in concrete would be considered lower than in soil):

PFAS NEMP (2020) Human health (direct contact) values for industrial / commercial;

PFAS NEMP (2020) Human health (direct contact) values for public open space;

PFAS NEMP (2020) Interim ecological (direct contact) values for all land uses; and

PFAS NEMP (2020) Interim ecological (indirect exposure) values for all land uses.

Concrete samples will also be analysed for PFAS ASLP to assess the potential for PFAS leaching from the concrete into soils, groundwater or surface water. Surface water criteria as listed in Table 3-1 and groundwater criteria as listed in Table 3-2 for the relevant environmental values will be applied to these results. The proposed sampling methodology (which will influence the results and applicability of criteria) is outlined in Section 5. However, given the potential safety and/or access limitations near the workshops, the methodology for collection and preparation of concrete samples may need to be revised at the time of conducting site work, in discussion with Batchfire and the Auditor.

3.1.3 Surface Water Samples

The adopted surface water criteria consider the surface water EVs for the Callide Creek Catchment, based on the DEHP (2011) document. Adopted surface water criteria are summarised in Table 3-1, below.

Table 3-1: Summary of Surface Water EVs and Adopted Criteria

Environmental Value	Supporting Information	Screening Criteria
Aquatic ecosystems	Surface water flows and water from mine dewatering activities are discharged into the surrounding surface water bodies including D West Cut (located within the Dunn Creek pit), Lake McCauley, East Dam and Dunn Creek Dam. Overflow from Dunn Creek Dam is expected to discharge to Callide Dam. Based on the PFAS NEMP (2020) and ANZG (2018), 99% species protection values should be applied for bioaccumulative substances.	PFAS NEMP V2.0, 2020 – freshwater 99% species protection
Industrial use	Water from Lake McCauley is used on site for maintenance and dust suppression activities. Water from Dunn Creek Dam is permitted to be discharged in accordance with the Callide Mine EA to Callide Dam. Callide Dam is located approximately 2.5km from the boundary of the mining lease. Callide Dam is used to supply cooling water to the Callide power stations.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water (given that there are currently no specific guideline values for this EV)
Drinking water	Callide Dam is utilised for potable water supply to the township of Biloele.	DoH (2019) Australian Drinking Water Quality Guideline Values
Irrigation, farm supply/use, stock water	Agricultural land use is located within the downstream catchment of Callide Creek. Water for agricultural uses are sourced from Callide Dam, Callide Creek and associated tributaries. A number of landholders have beneficial water reuse agreements with Batchfire.	DoH (2019) Australian Drinking Water Quality Guideline Values (conservatively applied, given that there are currently no specific guideline values for these EVs)
Visual, Primary and secondary recreation	EVs for Callide Dam, Callide Creek and associated tributaries are listed as being visual, primary and secondary recreation activities (e.g. boating and fishing).	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water
Cultural and spiritual values	Callide Dam and Callide Creek are considered to hold cultural and spiritual value. There are no specific criteria associated with cultural and spiritual values. However, the environmental quality objectives adopted for the protection of other beneficial uses, such as recreation, water dependent ecosystems and their species, in part, protect these beneficial uses. Consumption of organisms and plants may form part of the cultural values.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water
Human consumer	Recreational activities such as swimming, boating and fishing may result in consumption of PFAS impacted organisms or ingestion of PFAS impacted water.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water

If potential risks associated with bioaccumulation of PFAS in biota and/or consumption of PFAS affected organisms are identified (based on the results of soil, sediment, surface water or groundwater sampling and analysis), biota sampling may be required to quantify the risk. This sampling (if required) would be carried out in addition to the Stage 2 of the DSI. This risk would be assessed via a Human Health and Environmental Risk Assessment (HHERA).

3.1.4 Groundwater Samples

The adopted groundwater criteria consider current and future zoning and land use of the site and the groundwater EVs, based on the DEHP (2011) guidance. As such, the criteria adopted for the protection of these EVs are summarised in Table 3-2, below.

Table 3-2: Summary of Groundwater EVs and Adopted Criteria

Environmental Value	Supporting Information	Screening Criteria
Aquatic ecosystems	Shallow groundwater flows within the vicinity of the former Fire Training Area (FTA) may discharge into the Bathhouse Sediment Basin. Based on the PFAS NEMP (2020) and ANZG (2018), 99% species protection values should be applied for bioaccumulative substances.	PFAS NEMP V2.0, 2020 – freshwater 99% species protection
Irrigation, farm use or stock watering	Shallow groundwater flows near the former FTA may discharge into the Bathhouse Sediment Basin. Water from the Basin discharges into drainage channels connected to Lake McCauley. The drainage channel continues from Lake McCauley to Rail Loop Pond to Dunn Creek Dam. Water from East Dam and/or Ghost Ryders Dam is pumped through the Spine Pipeline connecting Trap Gully and Dunn Creek mining areas and can be intercepted via off-take points by landholders holding beneficial water reuse agreements with Batchfire.	DoH (2019) Australian Drinking Water Quality Guideline Values (conservatively applied, given that there are currently no specific guideline values for these EVs)
Industrial Use	Shallow groundwater flows near the former FTA may discharge into the Bathhouse Sediment Basin. Water from the basin then discharges into other dams on site and the water may be used for maintenance and dust suppression activities on-site.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water (given that there are currently no specific guideline values for this EV)
Drinking water	There is currently no record of groundwater extraction for potable use at the site or in the immediate vicinity of the site. However, the potential that groundwater is currently or may in the future be extracted for potable use cannot be discounted.	DoH (2019) Australian Drinking Water Quality Guideline Values
Primary recreation	Groundwater flow direction for the shallow alluvial aquifer is unknown, given the limited information currently available. Whilst it is possible that recreational activities may occur in surface water bodies (such as Callide Dam) south of the site, it is also unclear whether surface water bodies are gaining or losing, given the lack of current knowledge about groundwater / surface water interactions.	NHMRC (2019) – Guidance on Per and Polyfluoroalkyl Substances in Recreational Water

3.1.5 Biota Samples

Where soil, sediment, surface water and/or groundwater data indicates the potential for risks to aquatic or terrestrial ecosystems, the need for biota sampling may be triggered. No biota sampling was included in Stage 1 or Stage 2 of the DSI sampling, but this Stage 2 DSI Work Plan (and incorporated SAQP) includes off site sampling of surface water, soil and organic matter (biomass) where the results of a landowner survey on the use of beneficial water indicates that this is warranted.

Where biomass is sampled, an assessment of edible portions will be used in estimating the risks of exceeding the tolerable daily intakes. Reference documents for this assessment include:

Queensland Health Guideline (for sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination); and

Food Standards Australia and New Zealand (FSANZ) (for the adoption of portion sizes).

4. DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) have been developed to define the type and quality of data required to achieve the overall objectives of the assessment; being to fully characterise the nature and extent of PFAS impact in environmental media associated with any direct or indirect releases of PFAS at the site.

The Stage 1 PFAS data from the site has been assessed against criteria protective of identified human health and ecological receptors relevant to the current and future land uses.

The DQOs (outlined below) were developed with reference to the Heads of Environmental Protection Agencies (HEPA) PFAS National Environmental Management Plan (NEMP) (2020), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) and the National Environmental Protection Council (NEPC) 1999, amended 2013. *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM 2013) guidelines, which define minimum data requirements and quality control procedures.

Following on from the Stage 1 DSI, soil and water data gaps were identified in the following areas:

- Surface water sample CM_PW02 was not able to be collected from the eastern Dunn Ck pit, surface water samples TG_PW02 and TG_PW03 were not able to be collected from two pits at the Trap Gully area;
- Surface water sample CM_SW20 was not able to be collected from the Magazine Dam due to de-silting activities;
- Two soil samples CM_HA01 and CM_HA02, intended for the validation of the surface where a soil stockpile had been located (soil excavated from the Southern holding pond south of the main workshop) were not able to be collected due to the presence of the stockpile;
- Impacted soil was identified in the vicinity of the main workshop area of the Southern operations at the CM_SB05 and CM_SB07 locations, these locations require further sampling for impact delineation;
- Soil samples were not able to be collected from the CM_HA03 location within the AST bund due to encountering augur refusal on compacted surface material;
- A drainage path from the upper area on the southern side of the main workshop was identified which drained down a slope to the southeast and had not been previously investigated;
- Revalidation of surface water at the southern boundary weir, the Bathhouse Sediment Basin and the East Dam;
- Revalidation of groundwater from all groundwater monitoring wells;
- Revalidation of surface water in the Trap Gully sediment basin, and;
- Revalidation of Beneficial Water at off-takes from the Spine Pipeline (all sample taps) supplied to off-site landowners.

4.1 Step 1: State the Problem

The objectives are to:

Assess conditions in environmental media (soil, sediment, surface water and groundwater) against screening criteria relevant for the land use (mining/agricultural);

Assess conditions in biota (if required by an updated SPR linkage) against relevant screening criteria;

Produce a Stage 2 DSI (targeting only PFAS, as previously outlined in Section 1) for submission to the administering authority that demonstrates that Requirement 6 of the EEN has been met.

Specific requirements of the EEN are:

- Assess the results of the Stage 1 DSI for PFAS impacts that require further investigation for delineation and for gaps in the Stage 1 sampling that require further investigation;
 - Biota sampling must be included as part of the investigation if there are shown to be potentially complete source-pathway-receptor linkages as per the CSM;
 - Identify pathways including, but not limited to, the premises, surface waters, drainage lines, stormwater infrastructure and groundwater in the vicinity of the premises;
 - Assess the nature of the connectivity/completeness of those pathways by assessing groundwater levels versus surface water levels and connectivity, hydraulic conductivity and groundwater velocity, and evaluate the potential for contaminant migration offsite and into Callide Dam during heavy rainfall events, ensure that there is sufficient data to evaluate these pathways; and
 - The sampling and analysis must include all requirements stated in Requirement 9 of the EEN.
- It should be noted that the scope of the DSI is limited to PFAS (and no other hazardous contaminants), and therefore the content requirements of a CLID may not be met. Under these circumstances, clause 8 of the EEN may not be able to be satisfied as the EP Act does not allow the scope of a CLID to be limited. The Auditor's review of the DSI report will be conducted on this basis.

4.2 Step 2: Identify the Decisions

The decisions to be made based on the proposed scope of work and objectives are as follows:

Do environmental media (soil, sediment, concrete, surface water, groundwater and biota (where appropriate)), meet the adopted criteria suitable for the current land use, and the protection of human health and ecological receptors?

Have secondary source(s) of PFAS been identified that may represent an ongoing risk to downstream receptors, requiring the application of additional screening criteria to assess the potential for indirect risks?

Is the data collected during this investigation sufficient to provide an assessment of the environmental condition and extent of any existing contamination to environmental media to support risk-based decision making?

Do residual impacts (if any) represent a potential risk to identified human health (industrial workers) and ecological receptors on-site, or to off-site agricultural users, residents, aquatic ecosystems or via food chain linkages?

Does the data obtained meet the requirements of the EEN?

4.3 Step 3: Identify Inputs to the Decisions

The inputs required to make the above decisions are:

Identification of representative sampling locations, including in areas where a PFAS impact has been identified but not delineated;

Groundwater and surface water field screening data (pH, dissolved oxygen, redox potential, conductivity and turbidity);

Determining groundwater and surface water interactions, groundwater recharge and discharge and groundwater flow rates and direction/s from the Stage 1 DSI data;

Are concentrations of PFAS compounds present in surface water and groundwater near site boundaries (which may indicate off-site discharge);

Do concentrations of PFAS compounds in soil and sediment and the leachability of PFAS in soil and sediment under natural conditions present a risk to human health and ecological receptors;

Do PFAS concentrations in concrete (at the workshops) and leachability present an on-going source of PFAS that may impact human health and/or the environment;

Bioaccumulation and biomagnification of PFAS in biota (if necessary);

Field and laboratory quality assurance/quality control data; and

Adopted criteria outlined in Section 3 above.

4.4 Step 4: Define the Study Boundaries

The spatial boundaries are shown on *Figure 1, Appendix A* as the site and cadastral boundary of Lot 100 on SP301602 (Main site), Lot 31 on RN869, Lot 23 on SP129150, (Callide Mine Southern Operations), Lot 31 RP899131 and Lot 1 SP200919 (Trap Gully area), and Lot 170 FTY1843 (The Hut area). The mine lease boundaries are also shown on these figures, and it should be noted that the mine lease boundaries and Lot boundaries do not always align.

The temporal boundaries of this investigation for water are to carry out surface water and groundwater gauging and sampling at selected times during a dry season and a wet season (at least one sampling event each) between July 2022 and July 2023 in order to assess the potential for seasonal variability. This includes beneficial reuse water samples from the Spine Pipeline off-takes.

Soil sampling from soil bores and from proposed groundwater monitoring bores will be conducted as part of the Stage 1 DSI activities. Sediment sampling of water storage dams will also be carried out during the Stage 1 DSI. Concrete sampling at the MIA workshop aprons may be completed as part of the Stage 1 DSI, if access is granted from the workshop manager. However, if concrete sampling is deemed unsafe (due to operational activities) or if it is assessed as having the potential to adversely affect the integrity of the concrete apron, alternative concrete sample collection and preparation (as outlined in Section 5) will be discussed with Batchfire and the Auditor, or soil sampling may be conducted beyond the concrete apron during the Stage 1 DSI to assess whether concrete sampling is necessary as part of the Stage 2 DSI.

Biota sampling, if required, is proposed to be carried out as an addendum to the Stage 2 of the DSI, at an appropriate time of the year when the biota may be expected to be abundant. The timing will be determined in consultation with specialists in biota sampling.

4.5 Step 5: Develop a Decision Rule

Laboratory analytical data will be assessed against the criteria as identified in Section 3.1.

Table 4-1: Decision Rules

Decision Required to be Made	Decision Rule
Is data acquired of acceptable quality for interpretive purposes?	Have appropriate controls and operating procedures been used, specifically: ■ Consistent sampling methods with appropriate sampling equipment with respect to PFAS, including appropriate decontamination procedures;

Decision Required to be Made	Decision Rule
	- Analytical techniques, both standardised method and detection limits appropriate to assessment criteria for different laboratories and for the same laboratories over time; and - QA/QC controls (field and lab) for samples recovered and tested are undertaken in accordance with the relevant stated quality parameters (as referred to in Section 6.1). If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No.
Has a sufficiently robust conceptual site model (CSM) been established?	The CSM has been progressively developed from the data obtained during the PSI and Stage 1 DSI investigations and follows the ASC NEPM (2013) and the PFAS NEMP (HEPA 2020) guidance. Data gaps identified in the later DSI have been targeted with the Stage 2 DSI sampling plan. Source – pathway – receptor linkages identified with the potential to be complete linkages have been targeted by the Stage 2 DSI to close these data gaps. If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No.
Based on soil, sediment, concrete, surface water, groundwater (and biota, if necessary) results, is the data obtained sufficient to provide an assessment of the environmental condition and extent of any existing contamination?	If there are exceedances of the adopted screening criteria (for the protection of receptors identified in the CSM), are there sufficient data inputs to the CSM to determine whether source-pathway-receptor linkages are presently complete or may be complete in the future? If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No.

4.6 Step 6: Specify the Performance or Acceptance Criteria

The acceptable limits on decision errors applied during the review of the results will be based on the data quality indicators of precision, accuracy, representativeness, comparability, and completeness, in accordance with the requirements of the ASC NEPM (2013).

The potential for significant decision errors will be minimised by:

Completing a robust QA/QC assessment of the validation data and application of the probability that 95% of data will satisfy the DQIs, therefore a limit on the decision error would be 5% that a conclusive statement may be incorrect;

Selection of appropriate screening levels that reflect the current and proposed future site use (mining/industrial); and

Selection of appropriate screening levels that reflect current off-site uses, including the protection of human and environmental values for recreational and drinking water uses.

4.7 Step 7: Optimise the Design for Obtaining Data

This Draft Work Plan has been developed based on samples collected as part of the PSI (soil, sediment, surface water and groundwater) and the Stage 1 DSI (soil, sediment, concrete, surface water and groundwater). The Stage 2 DSI design is limited to soil, surface water and groundwater sampling as concrete and sediment samples collected during the Stage 1 DSI have been deemed sufficient for the assessment of those potential pathways. The sampling design includes the following quality assurance measures:

- One intra-laboratory duplicate sample and one inter-laboratory duplicate sample per 10 primary samples collected (as required by the PFAS NEMP, 2020);
- One rinsate per field team member per day of sampling or per media type (whichever is greatest); and

- One trip blank sample per esky.

Rinsate samples will be submitted for PFAS (extended suite of compounds) analysis at super ultra-trace limits of reporting (LORs). Trip blank samples will be submitted for analysis for a short suite of PFAS compounds at super ultra-trace LORs.

Soil and sediment samples will be analysed to standard LORs. Soil and sediment samples will also be subjected to leaching tests with the criteria for water samples applied to the leachate solution analysis, requiring super ultra-trace LOR's for leachate solutions. Sediment samples will also be analysed for Particle size distribution (PSD) and total organic carbon (TOC). Laboratory QA/QC will be consistent with the requirements of PFAS NEMP.

Other PFAS-specific considerations / procedures that will be followed include:

- Sample locations with suspected elevated concentrations of PFAS will be sampled last, to limit the chance of sample contamination;
- All sample containers (to be provided by the selected laboratories) and consumable equipment (such as tubing for groundwater sampling) are to be polypropylene or HDPE (with no Teflon or Viton substances to be used); and
- No food wrappers, sticky notes, stain or water-resistant clothing, reusable freezer blocks, sunscreen, or insect repellent, unless certified PFAS free, will be worn or used during any stage of sampling.

The need for additional scope – to be developed as “Stage 2” of the DSI (e.g., for lateral or vertical delineation, or for temporal / seasonal assessment, or biota sampling) has been determined at the completion of Stage 1 of the DSI, in consultation with the Contaminated Land Auditor. The Stage 2 DSI works plan contained within this document is expected to address the identified additional scope.

5. PROPOSED SCOPE OF WORK AND METHODOLOGY

5.1 Stage 2 DSI

Data gaps remaining from the Stage 1 DSI indicate potential pathways are present within the current CSM. Supplementary samples will be collected where insufficient data is available to determine if a pathway is complete or not. Supplementary sampling may include:

- Resampling of groundwater monitoring bores to confirm the presence/absence of PFAS compounds from the Stage 1 results. The additional groundwater sampling will add temporal data and assist with the development of a model of groundwater movement;
- Resampling of selected surface water within the site to confirm Stage 1 DSI results. Some Stage 1 DSI samples were not able to be collected due to site activities. These locations will be sampled in the Stage 2 DSI. Additional surface water samples will add temporal data;
- Surface water and soil/sediment sampling of off-site receiving water bodies (subject to landholder questionnaire and property access), including those downgradient of off-site areas irrigated with beneficial reuse water;
- Organic matter/biota sampling, on-site and/or off-site (subject to landholder questionnaire and property access), and;
- Seepage monitoring of on-site dams.

The ERM Batchfire Callide PFAS DSI 2022 Progress Summary report (ERM - Dec 2022) following the Stage 1 DSI indicates that either potential pathways exist in surface water flow path areas of the

Southern Operations site and that the PFAS impact is not fully delineated in the areas to the east, west and northwest of the main workshop infrastructure of the site. Furthermore, some samples were unable to be collected due to operational activities such as dewatering of dams in preparation for the wet season. Stage 2 of DSI sampling will undertake the sampling of three media (soil, surface water and groundwater) for the delineation of PFAS impacts within the mine site. ERM will also attempt to collect any previously missed samples in order to close out data gaps. A summary of the Stage 1 sampling gaps is shown in Table 5-0 below.

Where additional analysis such as TOP Assy or ASLP testing is carried out on a primary sample, this analysis should also be carried out on corresponding replicate samples for QA purposes.

The Stage 2 DSI will also address off-site sampling of surface water (if present) soil and organic matter (biomass) based on the application of beneficial water (BW) supplied from the mine site. A landowner questionnaire has been prepared by Batchfire for distribution to landowners and the results of this questionnaire will determine the type sampling to be undertaken and the media to be sampled.

The data gained from these activities will inform the draft CSM and develop it further by closing data gaps that currently exist.

Table 5-0: Summary of Stage 1 DSI Sample Gaps

Location	Media	Identified Data Gap/s	Nearby Impacted Samples
North side of Southern Ops workshop	Soil	PFAS impact not delineated to the east and west of impacted surface sample locations	CM_SB02
South side of Southern Ops workshop	Soil	Impacted soil to the south of the main workshop not delineated to the south and southeast.	CM_SB04, CM_SB05 and CM_SB06
East side of Southern ops workshop	Soil	Impacted soil to the east of the main workshop not delineated to the east	CM_SB06
West side of Southern Ops workshop	Soil	Impacted soil on western side of main workshop not delineated to the west.	CM_SB07
Southern holding pond stockpile area	Soil	Surface beneath stockpile of material removed from the southern holding pond not able to be sampled during the Stage 1 DSI due to stockpile still in place.	Sediment and surface water in southern holding pond impacted
AST area of Southern Ops	Soil	Unable to collect soil sample at this location during Stage 1 DSI sampling event	None, missed sample
Groundwater monitoring bores	Water	Additional temporal (seasonal) data for the sites groundwater model	DC01, DC02, MB10, MB12, 1904, MB15, MB17, MB18 and MB19
Surface water bodies	Water	Additional temporal data for the sites surface water interpretation and missed sample of the Magazine Dam in the Stage 1 DSI.	Magazine Dam, Bathouse Sed basin, East Dam, Northern holding pond, Southern holding pond, Southern boundary overland flow path and Trap Gully Sed pond.
Pit water	Water	Additional temporal data for site water data and missed samples at Dunn Ck pit and Trap Gully pits during the Stage 1 DSI.	CM_DC02, CM_DC03, TG_PW02, TG_PW03,
Beneficial Water	Water	Additional temporal samples to build a more complete assessment potential impacts in mine site water being supplied to landowners. BW01 and BW02 samples not obtained during the Stage 1 DSI as sample valves were not yet fitted.	BW01, BW02, BW03, BW04, BW05

5.1.1 Soil Sampling

Prior to commencing any intrusive works, all sub-surface services will be located and marked on the ground (by Batchfire or their subcontractor). Dial Before You Dig (DBYD) plans will be consulted where available and ERM's sub-surface clearance program will be carried out to the extent possible to document the clearance process. Batchfire will also initiate an internal ground disturbance permit process prior to commencing drilling. Soil bores will be advanced using a hand auger only to a maximum of 1mbgs. An experienced ERM environmental scientist/engineer will log the soil strata and collect soil samples.

The rationale for soil sampling is included in Table 5-1 below. Note that two soil samples will be selected for analysis from each soil bore, with the exception of the stockpile surface validation bores CM_HA01 and CM_HA02, any remaining soil samples collected at each bore will be shipped to the analytical laboratory and placed on hold, pending the need for further vertical delineation.

In order to be able to delineate any surface soil impacts vertically, soil samples will be collected from deeper within the soil profile where possible. As a general rule, an interval of 0.5m between samples will be attempted throughout the vertical profile near the surface, however the field technician/s collecting the soil samples will use their discretion to vary this interval where soil strata are encountered such as rock layers, highly permeable sands or highly impermeable clays.

Deeper soil samples that are placed on hold at the laboratory may be analysed where the upper sample exceeds the site criteria for PFAS compounds. Where impacted soil samples are deemed to be within an area of the site that may allow PFAS to migrate off site (for example, sediment in a flow path leading to the site boundary), the soil sample may also be subjected to ASLP testing to determine the potential for PFAS to migrate to down gradient receptors. Samples selected for ASLP testing will therefore not necessarily have the highest concentrations of PFAS compounds.

Selected samples with the highest primary PFAS concentrations will be subjected to TOP Assy to establish the total detectable PFAS concentrations. This process results in otherwise unknown precursor fluorinated compounds becoming detectable as PFAS and the total of PFAS pre-TOPA is usually less than the sum of PFAS post-TOPA. The QA assessment of the laboratory results should include a check of the pre and post TOPA PFAS totals to ensure that the above statement is true.

Table 5-1: Soil Investigation Locations, Analysis, and Rationale

Location ID	Number of Samples	Analytical Suite	Rationale
CM_HA01 CM_HA02	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Validate footprint following removal of stockpiled material removed from southern holding pond (as shown on <i>Figure 2b, Appendix A</i>). Two near surface samples to be collected and both analysed. Hand auger to max depth of 0.5mBGL.
CM_HA03	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Assess potential for PFAS in soil within diesel AST area. No AFFF currently used (firewater only) but historical use unknown. Hand auger only to max depth of 0.5mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
CM_HA04	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Assess potential for PFAS in soil to the west of the previous CM_SB07 location for delineation of PFAS impact. Hand auger only, max 0.5mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
CM_HA05	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results)	Assess potential for PFAS in soil to the southwest of the previous CM_SB05 location for delineation of PFAS impact. Hand auger

Location ID	Number of Samples	Analytical Suite	Rationale
		1 x ASLP PFAS	only, max 0.5mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
CM_HA06	4 (2 primary, 1 intra-lab & 1 inter-lab duplicate)	4 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Assess potential for PFAS in soil to the south of the workshop on potential overland flow path for delineation of PFAS impact. Hand auger only, max 1.0mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
CM_HA07	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Assess potential for PFAS in soil to the north of the workshop location for delineation of PFAS impact. Hand auger only, max 0.5mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
CM_HA08	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Assess potential for PFAS in soil to the northwest of the vehicle wash bay location for delineation of PFAS impact. Hand auger only, max 0.5mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
CM_HA09	2	2 x PFAS extended suite 1 x TOP Assay (sample selected after PFAS results) 1 x ASLP PFAS	Assess potential for PFAS in soil to the east of the previous CM_SB06 location for delineation of PFAS impact. Hand auger only, max 0.5mBGL. Location as shown on <i>Figure 2a, Appendix A</i> .
Total No. Soil Samples (including duplicates)		Hand augers: 18 x PFAS extended suite, 8 x TOP Assay, 8 x ASLP PFAS	
Total No. Rinsates / Blanks		2 x Rinsates (PFAS extended suite (super ultra-trace)) 2 x trip blanks (PFAS short suite – (super ultra-trace))	

5.1.1.1 Soil Sampling Methodology

Soil samples will be collected and logged in accordance with ERM Standard Operating Procedures (SOPs), with regard to the PFAS NEMP (2020) advice on sample collection for PFAS testing. In summary, the following work procedures will be followed:

- The soil strata will be logged by appropriately trained and experienced environmental scientist/engineer in general accordance with AS 1726-1993;
- Soil samples from hand auger locations will be obtained from near surface, 0.25mbgs and 0.5mbgs and 1.0mbgs (where possible);
- Two soil samples will be selected from each soil bore for laboratory analysis, with the remaining samples placed on-hold. Upon receipt of the results, if required, additional samples will be analysed for the same parameters to further delineate vertically PFAS in soil/rock;
- Suitable personal protective equipment (PPE) including fresh disposable nitrile gloves will be used during sampling and equipment decontamination;
- The hand auger will be decontaminated between hand auger depth intervals firstly by removal of loose soil by brushing. The equipment will then be decontaminated by scrubbing with a cleaning solution (Alconox and water), rinsing with tap water followed by PFAS-free de-ionised water supplied by the laboratory. Soil samples will be collected directly from the augur;
- Representative soil samples will be collected in accordance with techniques described in ASC NEPM and the PFAS NEMP to maintain the representativeness and integrity of the samples and limit the potential for cross-contamination between samples or from external sources;

- The samples will be placed in laboratory supplied HDPE sample containers. The containers will be completely filled, where practical, to minimise headspace, before being sealed and appropriately labelled;
- Field quality control/quality assurance (QA/QC) samples will be collected, including intra- and inter-laboratory duplicates (at a rate of one in ten samples), rinsate blanks and trip blanks;
- Sample jars will be immediately placed in a cooler on double-bagged ice to limit the risk of introduction of contamination from external sources for the duration of shipment under Chain of Custody (COC) documentation to the relevant laboratory; and
- Cuttings from the hand auger will be compacted back into the hole and finished with bentonite grout, where necessary.

5.1.2 Sediment Sampling

Where characterisation of Stage 1 DSI sediment samples indicates exceedances of the trigger values, additional sediment samples will be collected for the characterisation of the source of the PFAS impact. Sediment at the weir to the southwest of the MIA workshop and in the Dunn Creek Dam discharge channel near RP1 may be sampled multiple times to establish if temporal variability occurs.

5.1.3 Concrete Sampling

The objective of the concrete sampling was to assess whether PFAS is present as a secondary / ongoing source, and whether it may be mobilised via surface run-off and/or via leaching and vertical migration (to soil and/or groundwater).

Samples from the northern (CON 01) and southern (CON 02) workshop aprons (upper and lower at each) were collected and analysed for PFAS compounds. One selected sample (CON 02 Lower) was further analysed for TOP Assay and ASLP. The TOP Assay indicated the presence of precursors and the ASLP test indicated that there is a potential ongoing source of PFOS exceeding the PFAS NEMP 99% ecological guideline. It is not proposed to further sample the concrete aprons in the Stage 2 DSI works.

The concrete aprons are well within the site boundaries and further sampling of the pathways between the workshop and the site boundary will instead be undertaken in the Stage 2 DSI works.

The concrete aprons are well within the site boundaries and surface water in contact with the concrete will then have to flow across bare soil in order to reach on-site receptors. The concrete results will be taken into consideration should some form of PFAS mitigation be recommended by the DSI report.

5.1.4 Surface Water Sampling

Surface water and shallow groundwater interactions have been investigated, although some data is incomplete at present. As such, the Stage 2 DSI scope will include the sampling of all groundwater monitoring bores (four new groundwater bores installed during the Stage 1 DSI works and five existing bores). Where there is surface water and a groundwater monitoring bore in close proximity, surface water and groundwater samples will be analysed for major ions and Total Dissolved Solids (TDS) in order to undertake a comparison of chemistry between groundwater and surface water and assess the potential for interaction.

Surface water sample locations have been selected to fill data gaps (where no samples have previously been obtained, for example, Magazine Dam), or to confirm previous surface water sample results. In addition, where seasonal surface water flows leading to potential off site receptors are present, these should be sampled on an opportunistic basis. This may entail some sample collection by Batchfire personnel.

Survey data (to be obtained from Batchfire mine planners and surveyors) for newly installed groundwater monitoring wells, surface water bodies (including the creeks sampled and the dams on

site), including invert levels (elevation of the base of creeks and dams) will be reviewed. This information will also contribute to the assessment of surface water / groundwater interaction and whether surface water bodies are 'losing' or 'gaining'.

Additional surface water samples are planned to be obtained from selected mine pits (pit water) that were not able to be accessed during the Stage 1 DSI works. Access was not possible in some cases due to operational activities in the area or due to the source being dry at the time of the site visit. Pit water samples (PW) have only been added where no other surface water samples provide coverage for the incident locations.

In addition to the surface water sampling locations, the Spine pipeline, which supplies beneficial use water (BW) will also be sampled at five off-take locations.

The BW sample locations, analysis and rationale is included in Table 5-2 below. Although the BW samples will be collected from off-takes close to both the Callide Mine and the Boundary Hill mine, for ease of interpretation, the results of all BW samples will be reported in the Callide Mine report. The pipeline flow direction will be confirmed with the Batchfire pump crew prior to each sampling event so that the water origin and flow direction is known.

ERM will liaise with Batchfire personnel in order to schedule sampling events that represent both flow directions in the spine pipeline.

The NEMP states that the performance of TOPA on water samples will be masked where the sum of Perfluoroalkyl Acids (PFAA) precursors divided by the sum PFAS <5%. The TOF analysis detects fluoro-organic compounds not readily detected by the standard PFAS analysis technique and provides a quantitative assessment, with a single cumulative parameter reported as the total PFAS concentration. Where a sample result is reported at close to a guideline value, TOF analysis may assist in the determination of a true PFAS concentration and therefore a guideline exceedance.

Samples selected from strategic areas such as regulated site water discharge points, will be subjected to TOF analysis.

Table 5-2: Surface Water & Beneficial use Water Investigation Locations, Analysis, and Rationale

Location ID	Number of Samples	Analytical Suite	Rationale
CM_SW20	1	1 x PFAS extended suite (super ultra-trace) 1 x TOF	Assess surface water in Magazine Dam for the presence of PFAS. Unable to obtain a sample in Stage 1. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_SW23	1	1 x PFAS extended suite (super ultra-trace) 1 x Major ions and TDS 1 x TOP Assay (low level)	Re-validate surface water in Southern Holding Pond due to previous CM_SW17 result. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_SW24	1	1 x PFAS extended suite (super ultra-trace) 1 x Major ions and TDS	Additional data point / seasonal data to characterise surface water in Northern Holding Pond, west of former FTA and north of workshops and refuelling area. Major ions and TDS data will be compared to data from nearby groundwater bores. Revalidation of previous CM_SW18 results. Sample location shown on <i>Figure 2a in Appendix A</i> .

Location ID	Number of Samples	Analytical Suite	Rationale
CM_SW25	1	1 x PFAS extended suite (super ultra-trace) 1 x Major ions and TDS 1 x TOF	Additional data point / seasonal data to characterise surface water in Bathhouse Sediment Basin (downstream of former FTA). Major ions and TDS data will be compared to data from nearby groundwater bores. Revalidation of previous CM_SW19 results. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_SW26	1	1 x PFAS extended suite (super ultra-trace) 1 x Major ions and TDS 1 x TOF	Additional data point / seasonal data to characterise surface water in southern point of discharge south. Major ions and TDS data will be compared to data from nearby groundwater bores. Revalidation of CM_SW16 results. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_SW27	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Additional data point characterise surface water in East Dam. Revalidation of previous CM_SW22 results. Sample location shown on <i>Figure 2a in Appendix A</i> .
TG_SW05	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Characterise surface water at Sediment Pond north / downstream of Trap Gully laydown area. Revalidation of TG_SW04 results. Sample location shown on <i>Figure 3 in Appendix A</i> .
CM_PW02	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Dunn Creek pit water sample unable to be collected in Stage 1 DSI. Sample location shown on <i>Figure 2b in Appendix A</i> .
CM_PW03	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Dunn Creek pit water sample to revalidate previous CM_PW01 results. Sample location shown on <i>Figure 2b in Appendix A</i> .
TG_PW02	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Trap Gully pit water samples to represent potential run-off in catchments where safety incidents potentially involving AFFF use occurred. Safe access required. Unable to sample in Stage 1. Sample location shown on <i>Figure 3 in Appendix A</i> .
TG_PW03	3 (1 primary, 1 intra-lab & 1 inter-lab duplicate)	3 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Trap Gully drainage line samples to represent potential run-off near approximate locations of safety incidents potentially involving AFFF use occurred. Unable to sample in Stage 1 (dry). Sample location shown on <i>Figure 3 in Appendix A</i> .
BW01	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Sample valve to be installed in a separate pipeline to the Spine Pipeline, providing water to the Selmanovic property, in order to obtain a representative sample of the beneficial reuse water originating from Boundary Hill. No sampling tap fitted in Stage 1. Sample location shown on <i>Figure 5 in Appendix A</i> .

Location ID	Number of Samples	Analytical Suite	Rationale
BW02	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Sample to be obtained from a tank valve. This tank supplies water to the Poulson property. No sampling tap fitted in Stage 1. Sample location shown on <i>Figure 5 in Appendix A</i> .
BW03_2	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Sample to be obtained from a tank valve. This tank supplies water to the Sheppard property. Revalidation of previous BW03 results. Sample location shown on <i>Figure 5 in Appendix A</i> .
BW04_2	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Sample to be obtained from an existing pipe valve adjacent to Ghost Ryder's Dam. This off-take represents the Brosnan property, which is the largest receiver of beneficial use water. This water is used for irrigation of crops and hosing down pig pens for their piggery. Revalidation of previous BW04 results. Sample location shown on <i>Figure 5 in Appendix A</i> .
BW05_2	3 (1 primary, 1 intra-lab & 1 inter-lab duplicate)	3 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level)	Sample Spine Pipeline from valve near an off-site tank (Hill Tank) south of Boundary Hill. This water represents the beneficial reuse water supplied to a number of landholders south of Boundary Hill. Revalidation of previous BW05 results. Sample location shown on <i>Figure 5 in Appendix A</i> .
Total No. Surface Water Samples (including duplicates)		<i>Surface Water – 6 x PFAS extended suite (super ultra-trace), 2 x TOP Assay (low level), 3 x TOF, 4 major ions and TDS</i> <i>Pit Water – 6 x PFAS extended suite (super ultra-trace), 3 x TOP Assay (low level)</i> <i>Beneficial Reuse Water - 7 x PFAS extended suite (super ultra-trace), 5 x TOP Assay (low level)</i>	
Total No. Rinsates / Blanks		<i>2 x Rinsates (PFAS extended suite (super ultra-trace))</i> <i>1 x trip blanks (PFAS short suite, (super ultra-trace))</i>	

5.1.4.1 Surface Water Sampling Methodology

Where available, dam 'as built' drawings and invert levels will be reviewed prior to the sampling event. Batchfire's survey and topographical maps will also be reviewed for data relating to the sites drainage lines and invert levels. Surface water bodies must be approached with care and therefore the sampling location is limited to the reach of the extendable pole from a safe position on the bank of the water body. ERM proposes the following methodology for the collection of surface water samples:

Samples will be collected using a laboratory-supplied PFAS suitable sample container on the end of an extendable pole in order to obtain a sample up to 1m from the shoreline where possible;

The sample container mounted on the pole will be immersed below the surface of the water to avoid, as much as possible, entraining any materials floating on the surface of the water;

Sample containers (HDPE, provided by the analytical laboratory) will be completely filled to minimise headspace, before being sealed and appropriately labelled. Sample containers will be placed in a cooler on double-bagged ice immediately to minimise potential for introduction of external contaminants to samples during shipment under COC documentation to the laboratory;

Non-dedicated sampling equipment will be decontaminated prior to sampling at each location, by washing with tap water mixed with Alconox and rinsing with tap water followed by PFAS-free de-ionised water provided by the laboratory; and

Field parameters (when stabilised, as per the guidance outlined in Table 5-4, below) will be logged by lowering the water quality probe into the water body up to 1m from the shoreline after the collection of the sample to avoid the potential for cross contamination. The probe set will be washed with a mixture of tap water and Alconox, then rinsed with tap water followed by PFAS-free de-ionised water after each use.

5.1.5 Groundwater Sampling

Four monitoring bores installed as part of the Stage 1 DSI and five existing groundwater bores will be included in the sampling program. The groundwater sampling methodology is described in Section 5.1.4.1 below.

Surface water and groundwater samples obtained from proximal locations will be analysed for major ions and Total Dissolved Solids (TDS) in order to enable comparison of chemistry between groundwater and surface water and assess the potential for interaction.

This will also be supported by high precision height surveys of the bores and the installation of height datum reference markers at the surface water bodies.

Corrected groundwater levels (relative to metres above Australian Height Datum (mAHD)) in shallow monitoring bores will be calculated in order to estimate groundwater flow directions.

The new and existing hydrogeological information, including survey data, slug tests, temporal groundwater chemistry data, as well as accessing Batchfire's geological model for the site, will be used to develop a conceptual site hydrogeological model. This will be used to inform groundwater flow regimes, surface water interactions and any migration pathways between shallow and deep aquifers.

Table 5-3: Groundwater Investigation Locations, Analysis, and Rationale

Location ID	Number of Samples	Analytical Suite	Rationale
MB10	3 (1 primary, 1 intra-lab & 1 inter-lab duplicate)	3 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level) 3 x major ions and TDS 1 x TOF	Reconfirm / obtain seasonal data for MB10, near former FTA. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
MB12	1	1 x PFAS extended suite (super ultra-trace) 1 x major ions and TDS	Reconfirm / obtain seasonal data for MB12, at refuelling area, north of workshops. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
DC01	1	1 x PFAS extended suite (super ultra-trace) 1 x major ions and TDS	Resample to confirm no PFAS present. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
DC02	1	1 x PFAS extended suite (super ultra-trace) 1 x major ions and TDS	Resample to confirm no PFAS present. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .

Location ID	Number of Samples	Analytical Suite	Rationale
1904	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level) 1 x major ions and TDS	Resample to confirm PFAS detected during Stage 1 DSI. Install Hydrasleeve without purging to avoid issues with slow recharge. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_MB15	1	1 x PFAS extended suite (super ultra-trace) 1 x TOP Assay (low level) 1 x major ions and TDS	Characterise shallow groundwater southeast of the workshop area, adjacent the southern Mining Lease boundary. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_MB17, CM_MB18	2	2 x PFAS extended suite (super ultra-trace) 2 x TOP Assay (low level) 2 x major ions and TDS	Characterise shallow groundwater south and east of Dunn Creek Dam, adjacent the southern Mining Lease boundary (north of Callide Power Station). Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
CM_MB19	1	1 x PFAS extended suite (super ultra-trace) 1 x major ions and TDS 1 x TOF	Characterise shallow groundwater south of the former FTA. Major ions and TDS data will be compared to data from nearby groundwater bores. Sample location shown on <i>Figure 2a in Appendix A</i> .
Total No. Groundwater Samples (including duplicates)		11 x PFAS extended suite (super ultra-trace), 5 x TOP Assay, 1 x TOF, 10 major ions and TDS	
Total No. Rinsates / Blanks		2 x Rinsates (PFAS extended suite (super ultra-trace)) 1 x trip blank (PFAS short suite, (super ultra-trace))	

5.1.5.1 Groundwater Sampling Methodology

Some bores have a SWL too great for the use of a peristaltic pump. ERM proposes to use HDPE Hydrasleeve samplers to collect representative groundwater samples, noting that Hydrasleeves are supported as a sampling method in the PFAS NEMP. Hydrasleeves are a no-purge system that allows for the sample bag to be set in place over long time frames (3-6 months) between sampling events. The sites groundwater monitoring bores are constructed with bentonite seals above the filter pack to prevent surface water inflows via the drilled soil bore and are fitted with well caps to prevent rainwater ingress.

Hydrasleeve components are inert and do not contain PFAS materials, thus not introducing contaminants into the groundwater to be sampled. The long deployment time between sampling events ensures that fresh groundwater will flow through the well between sampling events and provide fresh, representative, groundwater samples. The Hydrasleeve sample bag is fitted with a self-closing valve at the top that excludes further collection of water once the bag is full, excluding the collection of any stale water in the standpipe of the well. The bag fills as it is drawn upward through the water within the screened section of the well, where groundwater crossflow is expected to occur.

The following methodology will be employed for the collection of groundwater samples:

- Each bore will be gauged to Standing Water Level (SWL) using an interface probe. The total depth will be gauged after removal of the Hydrasleeve;

- HDPE Hydrasleeves have been selected as the most appropriate method for the on-going PFAS sampling of the sites groundwater bores as this method eliminates the potential for cross contamination when using a submersible pump. Hydrasleeve equipment other than the sample bag itself will be dedicated to the individual monitoring bore. The sample bag is discarded and replaced at each sampling event. HDPE Hydrasleeves will be set and left to equilibrate for at least two days prior to sampling;
- HDPE Hydrasleeves will be installed in approximately the centre of the screened section of each bore, where possible, so that the groundwater sample is collected from the section of the well where flow-through of groundwater is expected;
- Samples obtained from Hydrasleeves will be placed directly into laboratory-supplied sample bottles, these bottles will be placed in eskies with double bagged ice for preservation;
- Field parameters (pH, electrical conductivity, oxidation-reduction potential, temperature and dissolved oxygen) will be measured using a calibrated water quality meter and a flow cell (if a low-flow pump is used) or from a portion of the sample obtained from the Hydrasleeve in a PFAS free container (static cell). The indicative stabilisation criteria are as described in Table 5-4 below;
- One primary sample will be collected per bore, with intra-laboratory and inter-laboratory duplicate samples to be obtained at a rate of one per ten primary samples;
- Sample containers (HDPE, provided by the analytical laboratory) will be completely filled to minimise headspace, before being sealed and appropriately labelled. Sample containers will be placed in a cooler on double-bagged ice immediately to minimise potential for introduction of external contaminants to samples during shipment under COC documentation to the laboratory; and
- Non-dedicated sampling equipment (e.g., the interface probe) will be decontaminated prior to sampling each bore by washing with tap water mixed with Alconox and rinsing with tap water followed by rinsing with PFAS-free de-ionised water provided by the laboratory.

Table 5-4: Water Quality Parameter Stabilisation Criteria

Parameter	Indicative Stabilisation criteria
pH	± 0.1 pH units
Electric Conductivity (EC)	± 3% μ S/cm
Temperature	± 0.5°C
Oxidation Reduction Potential (ORP)	± 10 mV
Dissolved Oxygen (DO)	± 0.3 mg/L

It is noted that both ORP and DO are typically slower to stabilise than the other parameters and may be particularly unstable when not using a closed flow through cell. In this case, greater weight will be given to pH and EC as the 'stabilising' parameters. Temperature should be recorded immediately as the temperature of the water in a static cell will be affected by the length of time it is exposed to the ambient temperature.

5.1.6 Landholder Beneficial Water Use Sampling Plan and Human Health and Ecological Risk Assessment

The scope of the biota / biomass sampling program has been developed based on the findings of Stage 1 of the DSI and the landowner questionnaire and in conjunction with an in-house Risk Assessment that considers these sources of data. Due to concentrations of PFOS and PFHxS detected in the beneficial use water supplied to landowners which exceed freshwater high conservation value systems (99%) and NEPM drinking water criteria, an investigation is required to determine if there is a potential accumulation of PFAS products in BW receiving environments as detailed below.

The results of this investigation will need to provide sufficient data to enable assessment of the reporting requirements of Section 3 of the EEN and s. 320 of the EP Act. Both an understanding of PFAS source/s and management controls for the supply of beneficial water to landowners will be required to assess the ongoing risk to landowners. Management may include sourcing water for off-site supply from reservoirs distant to and up-gradient of known PFAS releases and which have been tested to ensure that they are PFAS free.

The first stage of off-site biota (initial landowner assessment) sampling includes sampling of:

- Water bodies either within or downgradient to BW application areas (if present) where surface water runoff may have accumulated;
- Shallow soil (upper 0.5m) within BW application areas; and
- Plant material (representative crops) within BW application areas.

For a more complete assessment, plant material (biomass) may be divided into roots, stems, foliage and edible portions such as fruit (where present), with each part individually analysed. The full procedure for sampling biomass was developed in consultation with the analytical laboratory and ERM's ecology team for incorporation into the Work Plan. The detailed sampling plan may be viewed in Table 5-6 below.

A further scope of biota sampling may be considered based on the findings of the initial landowner assessment. The additional biota sampling program may include aquatic ecosystem/s and human recreational water bodies. This would be developed based on the understanding of aquatic ecosystem food web and an assessment of the diet of key species. A review of key recreationally caught aquatic species would also be taken into account.

Following the development of the site-specific foodweb, target organisms may be selected where a potential pathway is found to be likely in accordance with the SPR linkages in the updated CSM.

An assessment of edible portions will be used in estimating the risks of exceeding the tolerable daily intake with reference to the Queensland Health Guideline and portion sizes recommended by Food Standards of Australia and New Zealand.

Preliminary results of the water use survey (WUS) were provided by Batchfire on 13 February 2023 for ERM's review. The results were reviewed to develop an approach for the further assessment of potential health risks posed to human and livestock receptors at properties that utilise mine-derived water for beneficial uses such as drinking water and growing foods for private consumption. Figure 5-1 below outlines the potential source-pathway-receptor linkages of use of the Beneficial Water on the landholder properties.

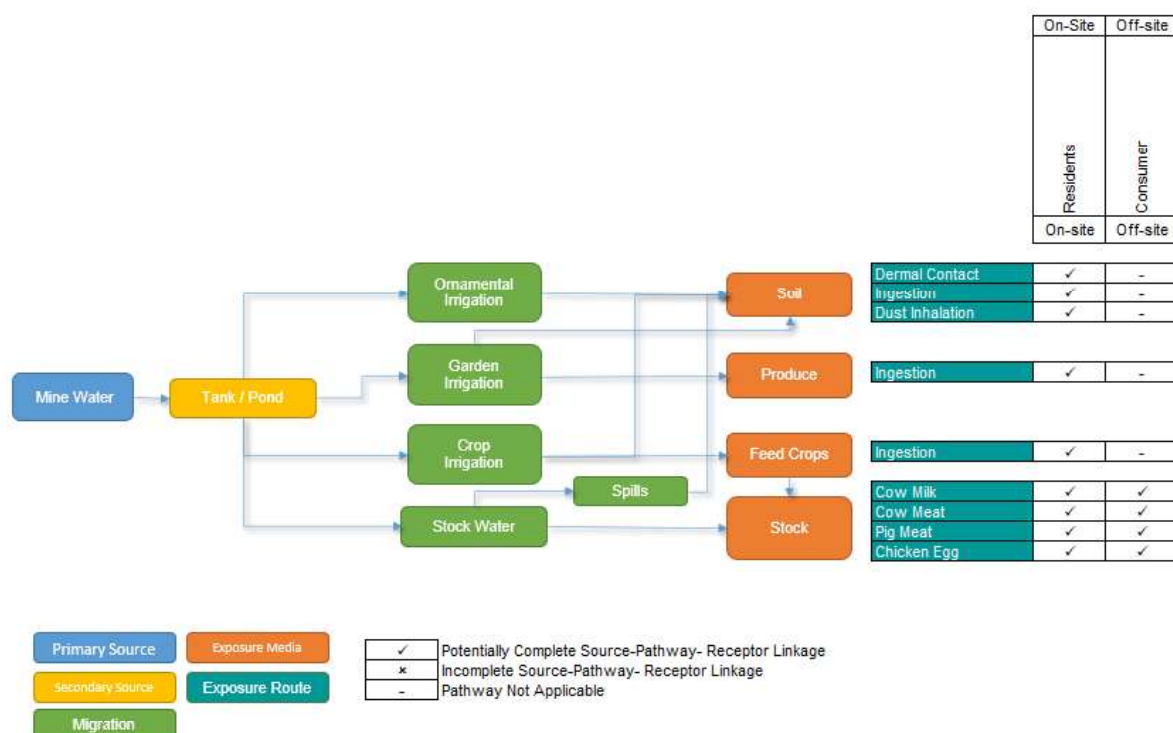


Figure 5-1. PFAS Transfer into Relevant Media

5.1.6.1 Summary of Key WUS Results

From the preliminary WUS results, the following high-level understanding can be concluded:

Beneficial uses of mine-derived water were identified to be any combination of those summarised in Table 5-5. It is acknowledged that complete access to landholder properties may not be provided due to currently understood community sentiments. ERM will only visit landholders and only include those that provide consent in the HHERA.

A total of 14 of 18 interviewed properties are candidates for further assessment of potential human health and/or ecological health risks given the current ways by which landowners are using their mine-derived water. Use of this water may cause potential risks to the health of human and/or livestock receptors by exposure to PFAS from within the water or by transfer of PFAS into other media of concern (e.g. soils, drinking water sources, home-grown foods). The locations of these properties are shown below in Figure 5-2;

Out of the above 14 candidates for further assessment, only eight have provided agreement for further testing;

A total of three properties did not have active connections to mine-derived water, as follows:

- L1 RP614399 connected 3 March 2023 and indicated future use of the water for edible gardens and lawn irrigation;
- L128 RP620207 agisted and owned by Batchfire; and
- The Loader property, at which a water agreement was signed but not yet activated by the time of this HHERA.

It is acknowledged that complete access to landholder properties may not be provided due to currently understood community sentiments. ERM will only visit landholders and only include those that provide consent in the HHERA.

Table 5-5. Identified Beneficial Uses of Mine-Derived Water (by February 2023)

Beneficial Use of Mine-Derived Water	No. of Properties	Notes
Potable water supply (human)	Nil	All 18 properties indicated that mine-derived water is not being used for potable water purposes at their property.
Gardens – ornamental and lawns	6	-
Gardens – foods for human consumption	3	Two of these properties (L3 RP618127 & L4 RP618127) belong to the same broader family. One property (L1 RP614399) has plans to use mine-derived water for small crops like pumpkins but is not currently doing so.
Stock watering	3	Horses
	10	Cows (understood to be mostly beef cattle) It is acknowledged (hence not counted) that one property (L220 RN840 & L150SP195017 & L88 RN1475) indicated there is no stock watering activities as their cows are agisted.
	Nil	Pigs It is acknowledged (hence not counted) that one property (L220 RN840 & L150SP195017 & L88 RN1475) indicated there is no stock watering activities as their pigs are agisted.
	2	Poultry (mixed varieties)
Livestock feed	2	One property (L220 RN840 & L150SP195017 & L88 RN1475) is growing crops (barley, wheat, corn, sorghum) to feed their pigs. One property (L2 RP614399) is growing lucerne for stock feed and sells this off-farm.
Dust suppression	1	Banana Shire (L30 RP899131) is using mine-derived water for dust suppression along a stretch of Forestry Road in Mount Murchison.

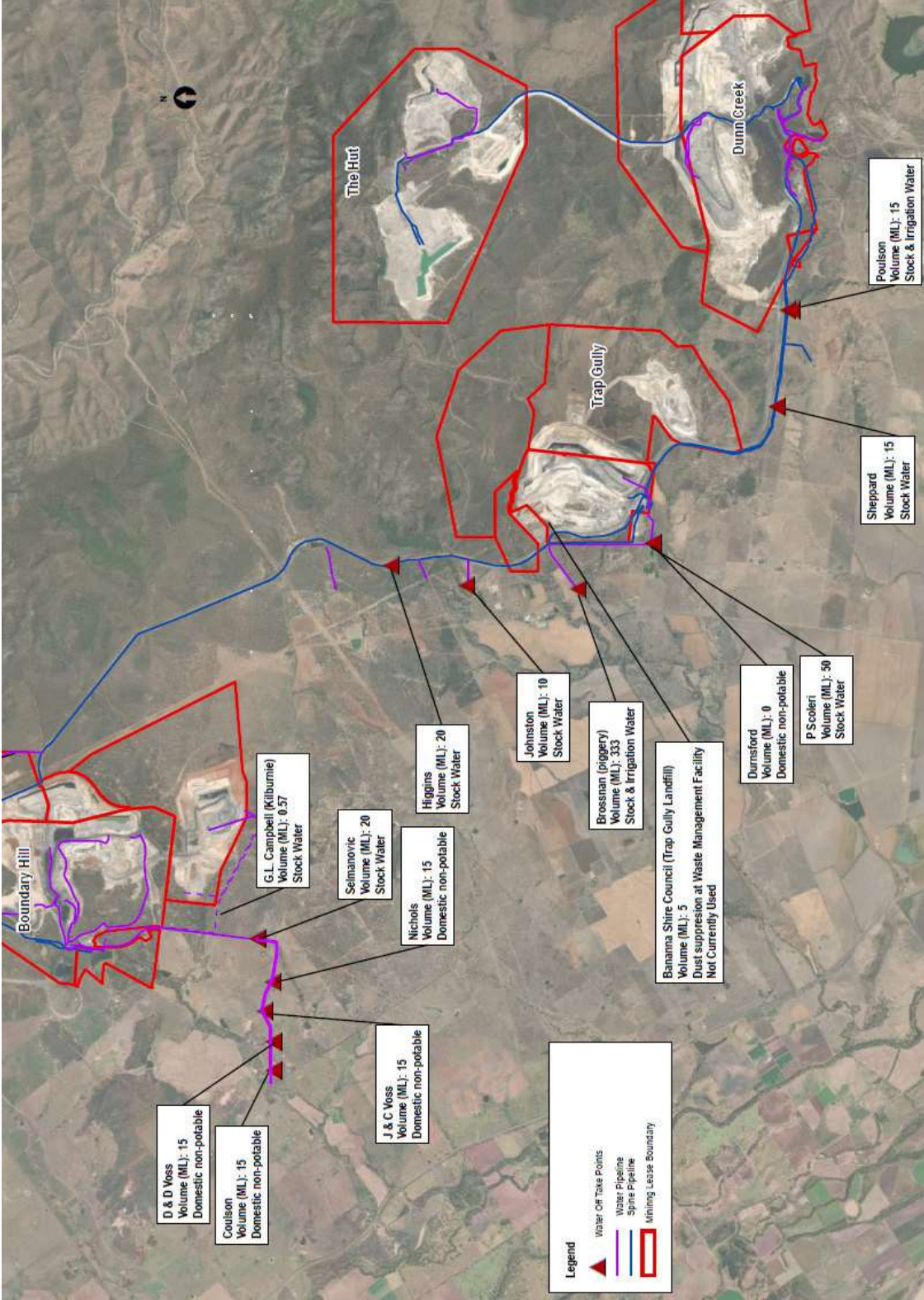


Figure 5-2. Landholder Property Locations

5.2 Proposed Properties and Sampling Schedule

Based on the preliminary understanding of beneficial uses of mine-derived water (Section 5.1.6.1), specific properties have been identified for further assessment in the HHERA. The list of properties and the proposed sampling plan is summarised in Table 5-6. It is noted that these sampling areas and numbers are subject to change.

Table 5-6. Proposed Properties to be Assessed and Associated SAP

No.	Property ID	Location	Landowner	Soil	Grass	Terrestrial Invertebrates	Water from Infrastructure	Edible Crops	Foods from Livestock	Comments
01	L4 RP618127	893 Argoon Kilburnie Rd, Biloela	D&D Voss	3 pasture areas 3 troughs 3 garden soils 2 lawns (profile top 1 m; 4 on hold) 1 chicken roaming area 4 delineating areas (8 on hold)	3 pasture areas 3 troughs 3 troughs	1 chicken roaming area	3 troughs 1 tank	1 veg 1 tuber 1 fruit	1 egg 1 meat^	To be refined ^(a) ^ Need to confirm if sample available (otherwise, will be modelled instead) Permission for sampling obtained
Primary sample total				12 (12 on hold)	6	1	4	3	2	
02	L3 RP618127	885 Argoon Kilburnie Rd, Biloela	J&C Voss	3 pasture areas 3 troughs 3 garden soils 2 lawns (profile top 1 m; 4 on hold) 1 chicken roaming area 4 delineating areas (8 on hold)	3 pasture areas 3 troughs 3 troughs	1 chicken roaming area	3 troughs 1 tank	1 veg 1 tuber 1 fruit	1 egg 1 meat^	To be refined ^(a) ^ Need to confirm if sample available (otherwise, will be modelled instead) Permission for sampling obtained
Primary sample total				12 (12 on hold)	6	1	4	3	2	
03	L5 RP618167	Argoon Kilburnie Rd, Biloela	Coulson	3 pasture areas 3 troughs 2 lawns (profile top 1 m; 4 on hold) 4 delineating areas (8 on hold)	3 pasture areas 3 troughs 3 troughs	-	3 troughs 1 tank	-	-	To be refined ^(a) Need permission

No.	Property ID	Location	Landowner	Soil	Grass	Terrestrial Invertebrates	Water from Infrastructure	Edible Crops	Foods from Livestock	Comments
Primary sample total				8 (12 on hold)	6	-	4	-	-	-
04	L2	811 Argoon	Nichols	3 pasture areas	3 pasture areas	-	3 troughs	-	-	To be refined ^(a) Permission for sampling obtained.
	RP618127	Kilburnie Rd, Biloea		3 troughs 2 lawns (profile top 1 m; 4 on hold) 4 delineating areas (8 on hold)	3 troughs 3 troughs	-	1 tank	-	-	
Primary sample total				8 (12 on hold)	6	-	4	-	-	
05	L96 RN418	893 Argoon	Selmanovic	3 pasture areas	3 pasture areas	-	3 troughs	-	-	To be refined ^(a) Permission for sampling obtained.
		Kilburnie Rd, Biloea		3 troughs 2 lawns (profile top 1 m; 4 on hold) 4 delineating areas (8 on hold)	3 troughs 3 troughs	-	1 tank	-	-	
Primary sample total				8 (12 on hold)	6	-	4	-	-	
06	170 FTY 1843	Argoon	GL Campbell (Kilburnie)	3 troughs	3 troughs	-	3 troughs	-	-	To be refined ^(a) Permission for sampling obtained
		Kilburnie Rd		4 delineating areas (8 on hold)	4 delineating areas (8 on hold)	-	1 main tank 1 dam	-	-	
Primary sample total				3 (8 on hold)	3	-	5	-	-	
07	L1	10364	Higgins	3 troughs	3 troughs	-	3 troughs	-	-	To be refined ^(a) * Dam overflow from GL Campbell's dam (property no. 6) therefore no further dam sampling required Permission for sampling obtained
	RP618390	Dawson Highway, Callide		4 delineating areas (8 on hold)	3 troughs	-	Dam not needed*	-	-	
Primary sample total				3 (8 on hold)	3	-	3	-	-	
08	L39	3212	Maynard (Batchfire)	3 troughs	3 troughs	-	3 troughs	-	-	To be refined ^(a) Permission for sampling obtained
	SP301585	Inverness Road, Jambin		4 delineating areas (8 on hold)	3 troughs	-	1 dam	-	-	

No.	Property ID	Location	Landowner	Soil	Grass	Terrestrial Invertebrates	Water from Infrastructure	Edible Crops	Foods from Livestock	Comments
Primary sample total				3 (8 on hold)	3	-	4	-	-	
09	L96 RN418	860 Argoon Kilburnie Road, Jambin	Selmanovic	3 troughs 4 delineating areas (8 on hold)	3 troughs	-	3 troughs 1 dam	-	-	To be refined ^(a) Permission for sampling obtained
Primary sample total				6 (8 on hold)	6	-	4	-	-	
10	L220 RN840 & L150SP19 5017 & L88 RN1475	10577 Dawson Highway, Callide	Brosnan	3 garden soils 4 delineating areas where water may be sprayed (8 on hold)	-	-	1 dam	1 wheat or barley* 1 sorghum or corn**	1 meat^	To be refined ^(a) * Sorghum and corn both from family Poaceae and subfamily Panicoideae but sorghum higher protein content. ** Wheat and barley both from family Poacea and subfamily Pooideae. Confirm what plant parts the stock eat and collect that in a representative composite sample. ^ Need to confirm if sample available (otherwise, will be modelled instead) Permission for sampling obtained
Primary sample total				3 (8 on hold)	-	-	1	2	1	
11	L52 RP843058 & L101 SP301602	426 Shorts Rd, Mt Murchison	Poulsen	2 lawns (profile top 1 m; 4 on hold) 4 delineating areas (8 on hold)	-	-	1 dam	-	-	To be refined ^(a) Permission not obtained
Primary sample total				2 (12 on hold)	-	-	-	-	-	

No.	Property ID	Location	Landowner	Soil	Grass	Terrestrial Invertebrates	Water from Infrastructure	Edible Crops	Foods from Livestock	Comments
12	L2 RP616094	10363 Dawson Highway, Callide	Johnston	3 troughs	3 troughs	-	3 troughs 1 dam	-	-	To be refined ^(a) ^ Need to confirm if beef cattle only Permission for sampling obtained
Primary sample total										
13	L2 RP614399	66 Freemans Road, Mount Murchison	P Scoleri	3 troughs 3 crop soils	3 troughs	-	3 troughs 3 dams	1 lucerne	-	To be refined ^(a) ^ Need to confirm if beef cattle only Permission for sampling obtained
Primary sample total										
14	L1 RP614399	88 Freemans Road Mount Murchison QLD	Mark & Jean Durnsford	Nil *	-	-	1 tank	-	-	To be refined ^(a) * Water connected 3 March 2023; have not started using it. Water tank may have mine-derived water present. To confirm.
Primary sample total										
15	TBD – Sheppard survey not done as of 30 March 2023			-	-	-	1	-	-	To be refined ^(a) Batchfire in process of obtaining consent from landowner to participate in HHERA.
Primary sample total										

Note: (a) Actual sampling numbers will be refined following completion of detailed interviews with landowners.

5.2.1.1 Pre-Sampling Site Visits

ERM proposes to complete pre-sampling site visits to ground truth the results of the WUS and proposed sampling plan summarised in Table 5-6. It is acknowledged that complete access to landholder properties may not be provided due to currently understood community sentiments. ERM will only visit landholders that provide consent for sampling. These site visits aim to:

Confirm the general property layout, key infrastructure and environmental media to sample, and further information from land users not yet elucidated from the WUS; and

To ensure that all relevant sampling equipment and consumables can be brought onto each property.

Following these site visits, the proposed sampling plan in Table 5-6 will be further refined and developed.

Landowners that have given consent for sampling are:

1. D & D Voss;
2. J & C Voss;
3. P Scoleri;
4. Brosnan;
5. Maynard;
6. Kilburnie;
7. Higgins;
8. Selmanovic;
9. Nicholls, and;
10. Johnson.

Landowners that have refused consent for sampling are:

1. Poulsen, and;
2. Coulson.

Landowners ruled out from sampling due to not yet applying beneficial water are:

1. Mark & Jean Durnsford, and;
2. Sheppard.

5.2.1.2 Biota / Biomass Sampling Methodology

The initial landowner assessment will use standard practices for the collection of soil and surface water samples. A plant matter collection methodology was developed in conjunction with the analytical laboratory requirements. The sample collection methodologies are detailed below:

- Surface water samples will be collected using a suitable HDPE container attached to a sampling pole. The sample will be collected approximately 1m from the shore line and from below the surface of the water to avoid collecting floating matter. The surface water sampling container and pole will be decontaminated between uses by washing with a PFAS free detergent and tap water solution, then rinsing with tap water and a final rinse with PFAS free water supplied by the laboratory.
- Soil samples will be collected using a hand augur to a maximum depth of 0.5mBGL. Samples will be collected at 0.25mBGL and 0.5mBGL. The augur will be decontaminated between depths by brushing off loose soil and washing in a PFAS free detergent and tap water

solution, then rinsing with tap water and a final rinse with PFAS free water supplied by the laboratory. Where possible, soil samples will be collected from the same location as biomass samples in order to determine if relationships between soil concentrations and biomass concentrations exist.

- Plant material (biomass) samples will be collected by uprooting the entire plant and storing the material in sealed HDPE bags. The entire root system (or as much as is practicable to extract) will be included. The roots will have excess loose soil removed prior to bagging by firstly shaking and brushing, and then by washing with PFAS free water supplied by the laboratory. Roots, stems, edible foliage and fruit (if present) will be separated in the field and placed in individual laboratory supplied containers for individual analysis of the biomass portions and to determine the potential pathway for PFAS uptake. Minimum biomass weight requirements as specified by Eurofins (recommended 20g and ideally 50g) will be met or exceeded for biomass samples. The sample area will be measured and photographed as part of the field documentation process.
- All samples will be immediately placed in eskies on double bagged ice and transported to the analytical laboratory under COC conditions. As the analysis of organic matter for PFAS is a specialised field, it is intended to use Eurofins, which are NATA accredited for this analysis, as the primary laboratory and ALS as the secondary laboratory in this instance. Samples will be subjected to cryogenic drying and freezing techniques in order to obtain representative samples for analysis from the raw sample materials provided.

Where the results of the initial landowner assessment, via the revised CSM, indicate that further off site sampling is warranted, the scope of this work plan will be updated accordingly. This may include the development of a technically defensible sampling scope for biota, in which a food web will be developed in order to identify the number and type of species to target. The aim of the biota sampling (if required) will be to assess potential impacts to aquatic ecosystems, the potential for bioaccumulation, and potential impacts to human health via consumption.

After identifying the target species, the next step will be the determination of the correct timing of sampling events for the efficient collection of representative target species. State Government and Local Government permitting requirements will be reviewed during the planning stages and complied with during sampling, accordingly. Finally, appropriate trapping/collection methods and the physical preservation and transport of trapped biota for laboratory analysis will be identified to ensure that specimens arrive at the laboratory for analysis under COC conditions with minimal risk of degradation or cross contamination during transportation.

5.3 Investigation Derived Waste

Investigation-derived waste generated during the Stage 2 DSI will be minimal, waste water from groundwater sampling activities, HDPE sleeves from groundwater sampling, nitrile gloves and other packaging and single-use materials (plastic wraps, bottles, etc.) generated during sampling activities.

Nine soil bores will be hand augured to a maximum depth of 1mBGL around the MIA for the further investigation of shallow PFAS soil impacts. Soil generated from hand auguring of soil bores will be compacted back into each bore. No waste soil expected to be generated from the soil bores.

6. LABORATORY ANALYSIS

The primary analytical laboratory selected for soil, sediment, surface water, groundwater and biota sample analysis is Australian Laboratory Services. The secondary analytical laboratory selected is Eurofins Laboratories. Both laboratories are accredited by the National Association of Testing Authorities (NATA) for the analytical suites proposed.

NATA laboratories carry out internal QA/QC testing and report these results. These include matrix spikes to gauge recovery and matrix interference, duplicate samples split from a primary sample for comparison, method blanks and surrogate recovery. For the analysis of TOP Assay, the laboratory will carry out quality assurance checks to confirm that oxidant exhaustion has not occurred. ERM will review the laboratory results to confirm this and may request the laboratory to re-run some samples, if warranted.

6.1 Quality Assurance and Quality Control

Reusable sampling equipment will be avoided where possible, to limit the risk of cross-contamination. However, where equipment (such as the interface probe for gauging groundwater levels) is required, it is to be decontaminated between uses, Alconox (which is PFAS-free) and tap water will be used, followed by rinsing with tap water and then rinsing with laboratory-supplied, certified PFAS-free deionised water. Where there is any doubt about whether or not materials or personnel are PFAS-free, or if there is any uncertainty arising regarding the potential for cross-contamination, additional rinsate samples will be collected.

QA/QC field sampling will include:

The collection of replicate QA samples at a rate of one set per ten primary samples of each media, with the secondary replicate samples sent for analysis at a secondary NATA accredited laboratory (Eurofins);

The collection of Rinsate samples at a rate of at least one per day of sampling from cleaned, reusable equipment; and

The placement of field trip blanks into each esky to confirm a lack of cross contamination has occurred in the esky during storage and transit.

Other PFAS-specific considerations and procedures that will be followed include the following:

- Sample locations with known or suspected elevated concentrations of PFAS will be sampled last where practicable, to limit the chance of sample cross contamination;
- All sample containers (to be provided by the selected laboratories) and consumable equipment (such as tubing for groundwater sampling) are to be high-density polyethylene;
- No food wrappers, sticky notes, stain- or water-resistant clothing, reusable freezer blocks will be used during any stage of the sampling; and
- No sunscreen or insect repellent will be worn or used during any stage of sampling unless certified as PFAS free.

7. REPORTING

7.1 DSI Report (CLID)

A DSI report (Requirement 7 of the EEN) will be prepared, detailing the findings of the sampling and analysis quality plan (both Stage 1 and Stage 2 of the DSI, as applicable) to determine the nature and extent of PFAS impact arising from any direct or indirect release of AFFF. The report will be prepared by a Suitably Qualified Person (SQP) but notes that DES has acknowledged (Environmental Evaluation E-100078550 – Requirement 5 – SAQP Workplan – Clarification, dated 19 May 2022) that the scope of the DSI is limited to PFAS (and no other hazardous contaminants), and therefore the content requirements of a CLID may not be met. Under these circumstances, clause 8 of the EEN may not be able to be satisfied, as the EP Act does not allow the scope of a CLID to be limited. The Auditor's review of the DSI report will be conducted on this basis.

7.2 Final Environmental Report

Following submission of the Auditor certified DSI to DES, a video conference will be scheduled to present the findings and facilitate any final discussions.

Following this discussion, a Final Environmental Report (Requirement 10 of the EEN) will be prepared. This report will comprise a brief document presenting statements that demonstrate that all requirements of the EEN have been met.

8. REFERENCES

Australian Department of Health (2017). *Health-Based Guidance Values for PFAS for Use in Site Investigations in Australia—Recreational Water Quality Value*.

Australia and New Zealand Guidelines for Fresh and Marine Water Quality 2023 (ANZG 2023, Toxicant default guideline values for aquatic ecosystem protection: Perfluorooctane sulfonate (PFOS) in freshwater;

Australian Department of Health (2019). *Australian Drinking Water Quality Value Guidelines*.

Australian Government (2012) National Water Commission: *Minimum Construction Requirements For Water Bores In Australia, Third Edition, February 2012*.

Epic Environmental (2022). CS Energy Limited *PFAS Investigation – Hydrological Review, Callide Power Station, BC200153.04, 4 April 2022*.

NHMRC (2019). *Guidance on Per and Polyfluoroalkyl Substances (PFAS) in Recreational Water*.

ANZG (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

DES (2009). *Queensland Water Quality Guidelines*.

DES (2010) *Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009 Version 2*. September 2010.

DES (2019). *Environmental Protection (Water and Wetland Biodiversity) Policy*.

ERM (2022). *Batchfire Callide Coal Mine, Coal Road, Biloea, Queensland; Callide Mine Site Per – and Poly-Fluoroalkyl Substances Preliminary Site Investigation (2021-2022) Project No: 0602830-01, 28 April 2022*

Food Standards Australia and New Zealand (FSANZ) Available on-line at:

<https://www.foodstandards.gov.au/science/monitoringnutrients/ausnut/assigningfood/Pages/assigningportions.aspx>

HEPA (2020). *PFAS National Environmental Management Plan (NEMP) Version 2.0*. January 2020.

NEPC. 1999, amended 2013. *National Environment Protection (Assessment of Site Contamination) Measure*.

NHMRC (2019). *Guidance on Per- and Polyfluoroalkyl Substances in Recreational Water*.

Queensland Government. 1994. *Environmental Protection Act*.

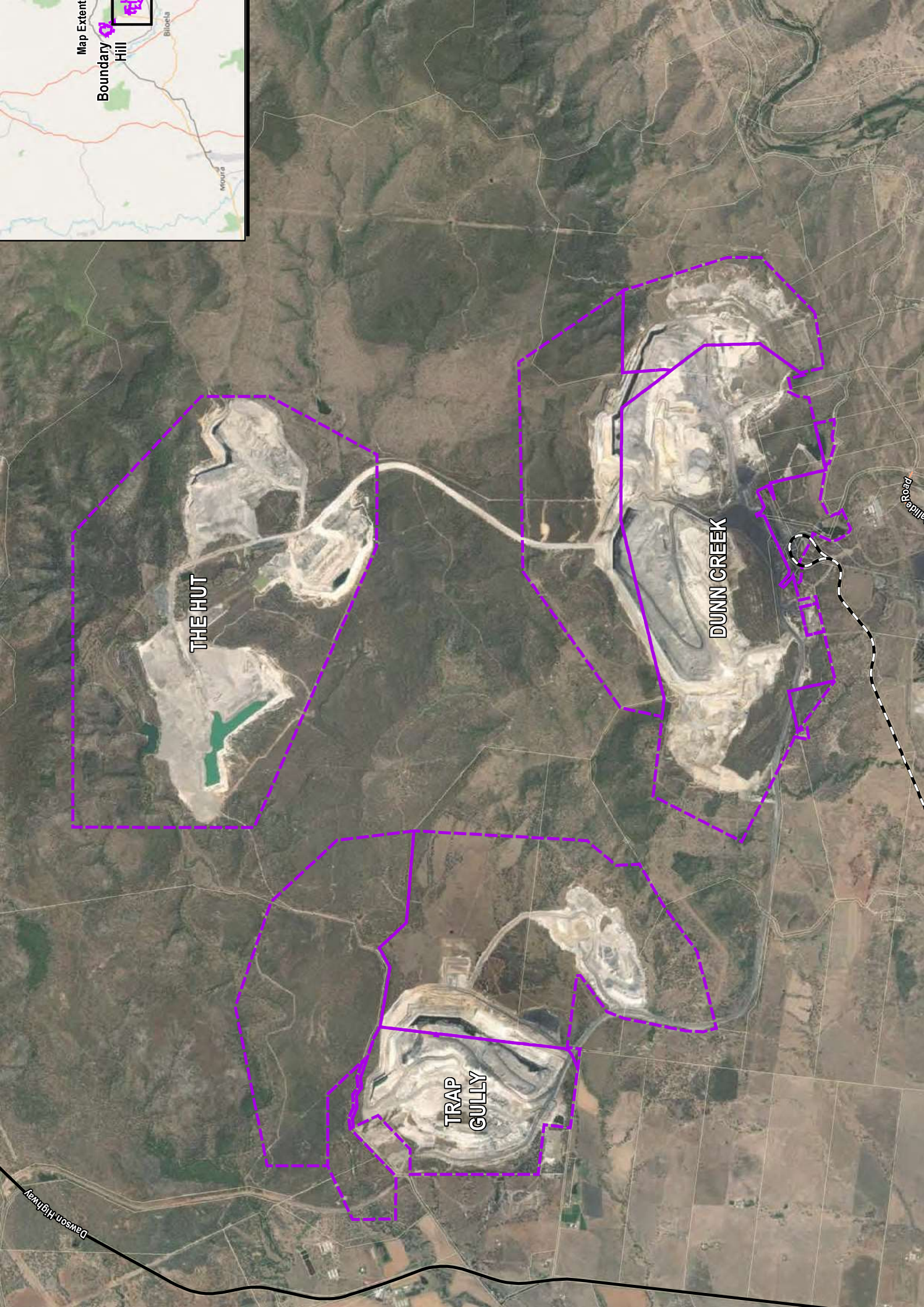
Queensland Health Guidance, *Guideline for the sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination*.

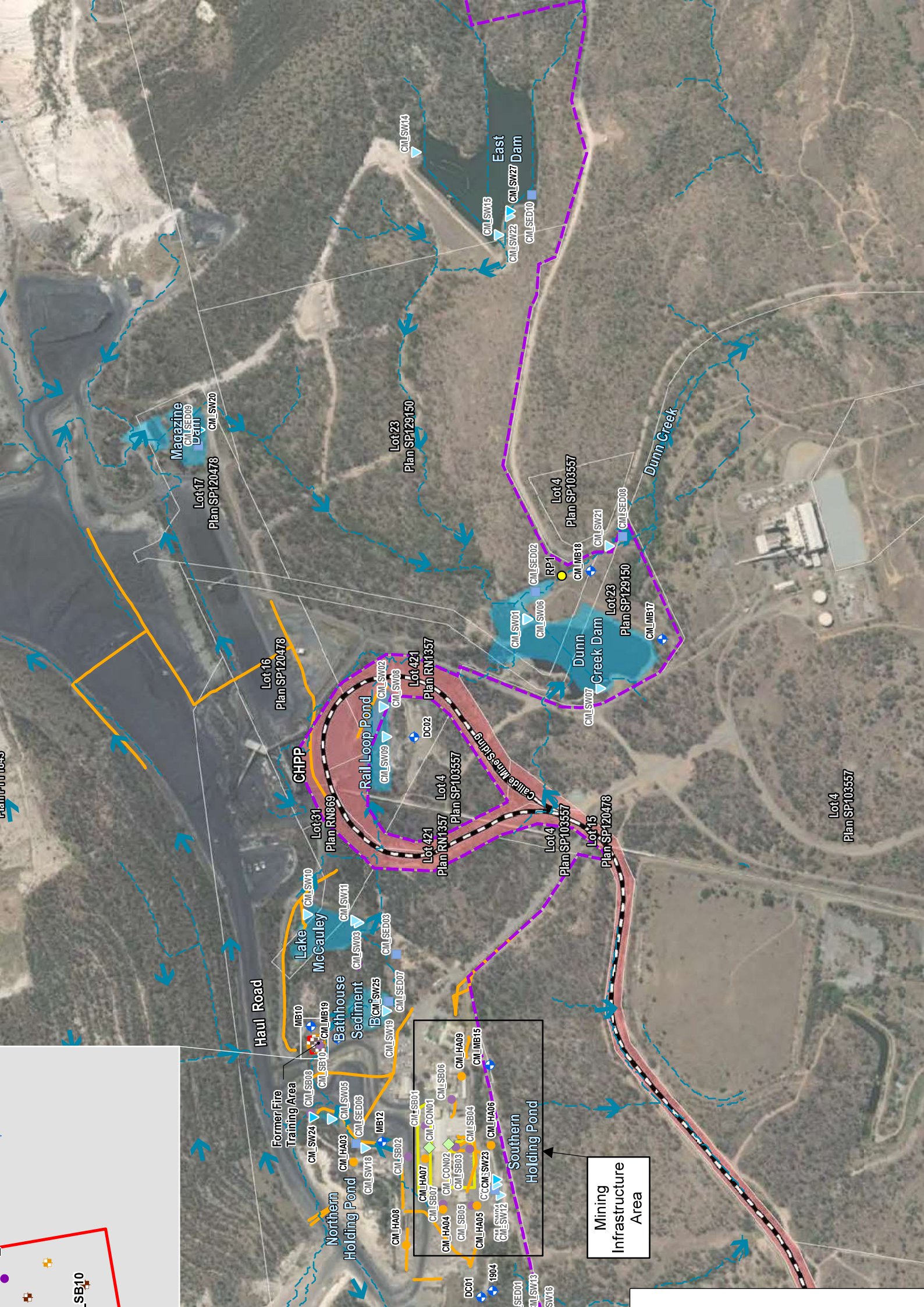
9. IMPORTANT LIMITATIONS AND CONTEXT

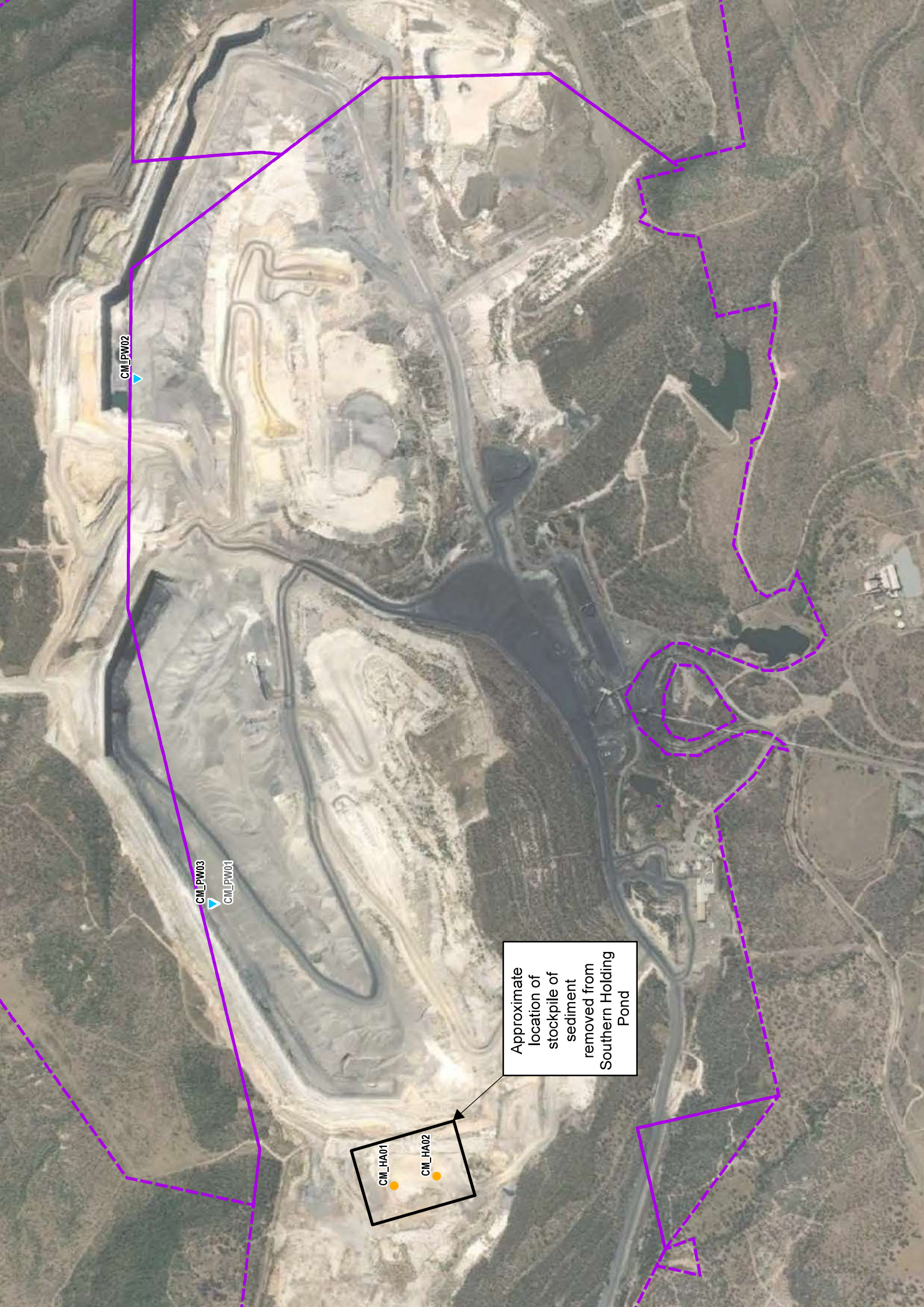
1. This report is based solely on the scope of work described in Batchfire PFAS Project Site Specific E2E Strategy Plan (ERM, 4 February 2022) (**Scope of Work**) and performed by ERM Australia Pacific Pty Ltd (**ERM**) for Batchfire Callide Management Pty Ltd (the **Client**). The Scope of Work was governed by a contract between ERM and the Client (**Contract**).
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between 2 May 2022 and 12 September 2023 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.
5. Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.
6. This report is based on one or more site inspections conducted by ERM personnel, the sampling and analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:
 - a. did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
 - b. assumes no responsibility or liability for errors in data obtained from,
the Client, any third parties or external sources (including regulatory agencies).
7. Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.
8. Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:
 - a. the suitability of the site(s) for any purpose or the permissibility of any use;
 - b. the presence, absence or otherwise of any environmental conditions or contaminants at the site(s) or elsewhere; or
 - c. the presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials on the site(s).

9. Use of the site for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited site auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.
10. The ongoing use of the site or use of the site for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.
11. This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.
12. Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:
 - a. has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
 - b. does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
 - c. does not purport to provide, nor should be construed as, legal advice.

APPENDIX A FIGURES







CM_LPW02

CM_LPW03

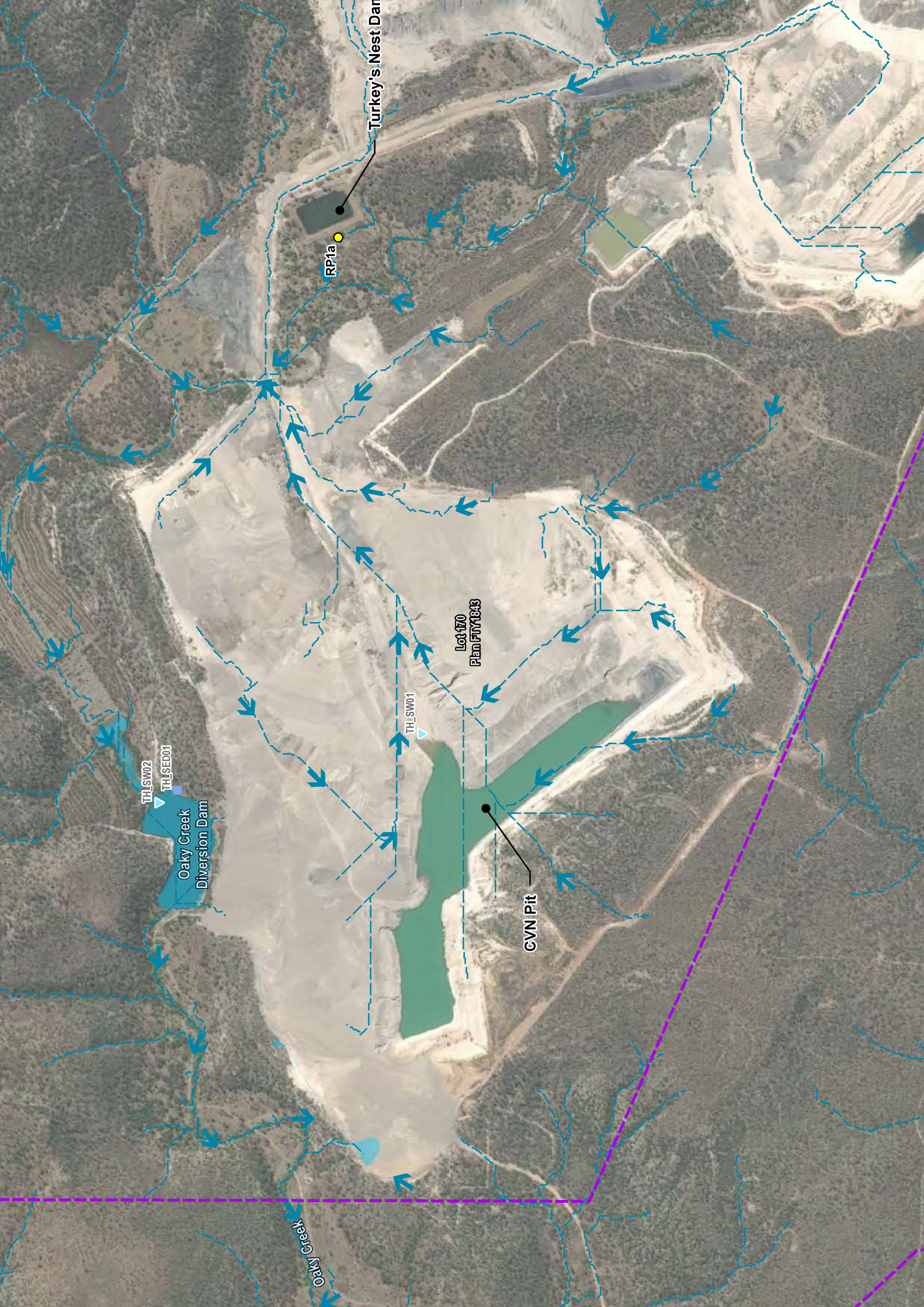
CM_LPW01

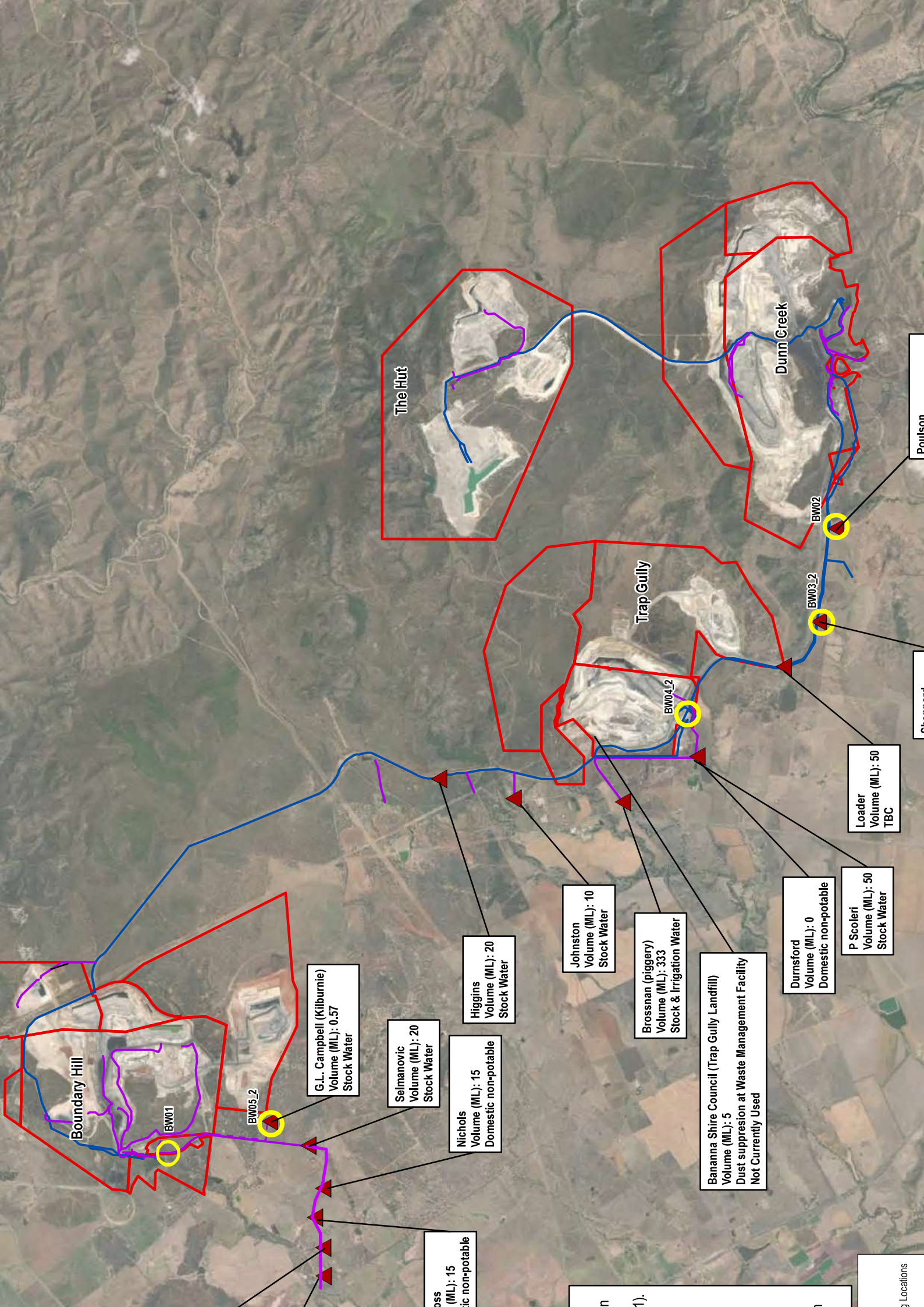
CM_HA01

CM_HA02

Approximate
location of
stockpile of
sediment
removed from
Southern Holding
Pond







**ERM has over 160 offices across the following
countries and territories worldwide**

Argentina	The Netherlands
Australia	New Zealand
Belgium	Peru
Brazil	Poland
Canada	Portugal
China	Puerto Rico
Colombia	Romania
France	Russia
Germany	Senegal
Ghana	Singapore
Guyana	South Africa
Hong Kong	South Korea
India	Spain
Indonesia	Switzerland
Ireland	Taiwan
Italy	Tanzania
Japan	Thailand
Kazakhstan	UAE
Kenya	UK
Malaysia	US
Mexico	Vietnam
Mozambique	

ERM's Brisbane Office

Level 9
260 Queen St,
Brisbane, QLD 4000

T: (07) 3839 8393

F: (07) 3839 8381

www.erm.com



APPENDIX C DATA TABLES

APPENDIX CONTENTS LIST

Data Tables - Southern Operations

Data Tables - Boundary Hill

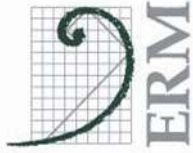


Table 1 - Groundwater Monitoring Bore Construction Details
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Well ID	Date of Installation	Casing Diameter (mm)	TOC Elevation (mRL)	TOC (mags)	Ground Surface Elevation (mRL)	Depth to Bottom-of-Well (mbgs)	Depth to Top-of-Well Screen (mbgs)	Lithology of Screened Interval
BH01	11-Oct-14	50	206.125	0.919	205.206	23	17	Siltstone and sandstone
MB08	Unknown	50	206.296	0.500 [^]	205.796	29	20	No Log, GWLDB indicates Basalt
MB28	12-Oct-20	50	197.161	0.800 [^]	196.361	18	6	Quaternary Alluvial
BH_MB01	27-28-Jul-22	50	203.866	1.019	202.847	22.5	14.5	Clayey SAND (Quaternary Alluvials)
BH_MB02	29-Jul-22	50	207.834	1.021	206.813	15.5	12.5	Sandy CLAY (Quaternary Alluvials)
BH_MB03	29-30-Jul-22	50	210.474	0.955	209.519	25	19	Rock (Tertiary Basalt)
BH_MB05	28-Jul-22	50	209.125	1.04	208.085	8.5	5.5	Clayey SAND (Quaternary Alluvials)

Source: Golders Associates (2014) Summary of EA Borehole Drilling, Golders Associates (2016) Summary of Groundwater Bore Drilling at DC01 and HUT01, Batchfire (2021) Groundwater Level Database (GWLDB), as provided to ERM March 2021

Notes:

TOC: Top of Casing

mbgs: metres below ground surface

mags: metres above ground surface

mRL: metres Relative Level, elevation levels sourced from GWLDB

* TOC elevations calculated from ground surface elevation and TOC (mags)

[^] Where TOC (mags) measurements were not provided, estimations from field observations were used

Elevation reference for MB08 and MB10 not provided in the GWLDB. Elevations provided are assumed to be ground surface.

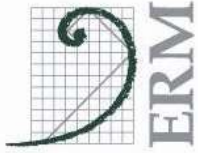


Table 2 - Hydrogeological Information
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Well ID	TOC Elevation (mRL)*	Total Measured Depth (mbTOC)	August 2021 Gauging	SWL (mbTOC)	February 2022 Gauging	SWL (mbTOC)	August/September 2022 Gauging	SWL (mbTOC)	March 2023 Gauging	SWL (mbTOC)	Change in groundwater level from August/September 2022 to March 2023	Corrected SWL Elevation March 2023 (mRL)
BH101	206.125	NR	16-Aug-21	3.342	09-Feb-22	3.310	30-Aug-22	3.257	21-Mar-23	3.345	-0.088	202.780
MB08	206.296	NR	16-Aug-21	1.800	10-Feb-22	1.725	30-Aug-22	NR	23-Mar-23	1.890	NA	204.406
MB28	197.161	NR	NR	NR	09-Feb-22	8.300	02-Sep-22	7.230	22-Mar-23	6.310	0.92	190.851
BH1_MB01	203.866	23.540	--	--	--	--	30-Aug-22	18.078	22-Mar-23	17.780	0.298	186.086
BH1_MB02	207.834	14.416	--	--	--	--	30-Aug-22	7.179	21-Mar-23	7.065	0.114	200.769
BH1_MB03	210.474	25.815	--	--	--	--	30-Aug-22	9.331	21-Mar-23	9.177	0.154	201.297
BH1_MB05	209.125	8.578	--	--	--	--	30-Aug-22	4.183	21-Mar-23	4.652	-0.469	204.473

Notes:

Operator: R.Lawrence

mbTOC: metres below top of casing

TOC: Top of Casing

mbgs: metres below ground surface

NR: Not recorded

mbTOC: metres below top of casing
mRL: metres Relative Level, elevation levels sourced from GWLDB

See Table 1 Notes regarding elevation assumptions and sources

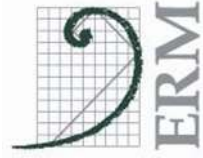


Table 3a - Groundwater Field Parameters
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Well ID	Purge/Sample Date	pH	EC (μScm^{-1})	Temp ($^{\circ}\text{C}$)	DO (mg/L)	ORP (mV)	TDS (mg/L)	Comments
BH01	17-Aug-21	6.40	41130	24.1	1.06	109.5	26323	Turbidity when purging
BH01	11-Feb-22	6.33	48479	24.1	4.33	127.7	31027	Turbid when purging, silt in bottom of HS
BH01	01-Sep-22	6.12	46333	23.8	3.31	74.7	29653	Clear water
BH01	21-Mar-23	5.75	46550	29.3	2.36	112.5	29792	Slightly turbid water
MB08	17-Aug-21	6.48	40591	23.2	0.57	-18.5	25978	Turbid and silty in bottom of hydrasleeve
MB08	11-Feb-22	6.25	46700	23.6	0.49	24.4	29888	Clear water, slight organic odour (ALS HS)
MB08	01-Sep-22	6.11	44300	23.5	0.41	58.3	28352	Slightly turbid water
MB08	23-Mar-23	6.07	45361	26.3	1.31	49.1	29031	Minor silt, slightly turbid water
MB28	11-Feb-22	5.84	17764	24.3	0.80	130.0	11369	Clear water, no odour, ants nesting in top of case (ALS HS)
MB28	02-Sep-22	5.03	25568	23.6	1.15	64.5	16364	Clear water, minor silt in bottom of Hydrasleeve
MB28	22-Mar-23	4.09	27694	29.8	1.09	336.4	17724	Turbid/silty water
BH_MB01	02-Sep-22	6.04	9856	24.7	1.6	79.8	6308	Clear water, minor silt in bottom of Hydrasleeve
BH_MB01	22-Mar-23	5.99	11467	27.9	1.05	80.6	7339	Minor silt in bottom of hydrasleeve
BH_MB02	01-Sep-22	6.42	67775	26.1	0.51	74.0	43376	Cloudy, slightly brown water
BH_MB02	21-Mar-23	6.64	68200	29.1	2.3	103.2	43648	Very turbid, silty water
BH_MB03	02-Sep-22	6.47	39609	25.5	3.34	63.1	25350	Clear water
BH_MB03	21-Mar-23	6.02	39575	28.1	0.9	44.6	25328	Silty water
BH_MB05	01-Sep-22	3.12	18344	27.0	0.57	113.8	11740	Highly turbid, silty water
BH_MB05	21-Mar-23	3.24	14102	31.5	1.1	131.6	9025	Turbid/silty water

Notes:

MB	Monitoring Bore	ORP	Oxidation-reduction potential
BH	Bore Hole	mV	millivolts
DO	Dissolved Oxygen	L	Litres
mg/L	milligrams per litre	TDS	Total Dissolved Solids (EC $\times$ 0.64)
EC	Electrical Conductivity	HS	Hydrasleeve
μScm^{-1}	microsiemens per centimetre	ALS	On site ALS lab
		Operator	R. Lawrence/ R. Cooke

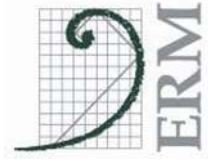


Table 3b - Surface Water Field Parameters
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Sample ID	Site Location	Date	pH	EC (µS _{cm} ⁻¹)	Temp (°C)	DO (mg/L)	ORP (mV)	TDS (mg/L)	Comments
PSI Results									
BH_SW01	Sediment Dam 3	15-Jul-21	NA	2,200	20.4	NA	17.9	1408	Not recorded
BH_SW03	Treated Water Pond	15-Jul-21	7.30	593	22.4	NA	-1.7	380	Not recorded
BH_SW04	Lake Gasteen	15-Jul-21	7.40	1,549	16.3	NA	-17.3	991	Not recorded
BH_SW05	Sediment Dam 3	07-Dec-21	7.83	2,421	31.0	5.40	153.3	1549	Cloudy
BH_SW06	Treated Water Pond	07-Dec-21	9.00	2,470	35.4	9.00	100.0	1581	Slight green colour and algae present
BH_SW07	Sediment Dam 2	07-Dec-21	5.17	3,156	36.8	4.53	208.9	2020	Cloudy
BH_SW08	Lake Gasteen	07-Dec-21	8.17	1,562	33.3	4.73	106.5	1000	Slightly cloudy and slight green colour
BH_SW09	Lake Gasteen	07-Dec-21	8.29	1,574	33.5	4.55	106.1	1007	Slightly cloudy and slight green colour
BH_SW10	Lake Gasteen	07-Dec-21	7.28	1,529	31.8	3.36	134.3	979	Slightly cloudy

First Round DSI Results

BH_PW03	Boundary Hill Pit Water	02-Sep-22	7.05	1866	19	6.58	64.2	1194	Clear water
BH_SW11	Lake Gasteen	31-Aug-22	NR	NR	NR	NR	NR	NR	NR
BH_SW12	RP3 Outflow channel	01-Sep-22	7.43	211	21.7	7.11	55.4	135	Highly turbid, silty water
BH_SW13	Sediment Dam 2	01-Sep-22	6.66	1822	22.4	4.43	69.9	1166	Turbid water, BH Sediment Dam
BH_SW14	Escape Tunnel outflow	01-Sep-22	7.19	1894	23	4.95	69.5	1212	Slightly turbid water, BH Escape Tunnel
BH_SW17	Gate Creek below Lake Gasteen	31-Aug-22	7.11	1985	25.1	5.13	63.2	1270	NR

Second Round DSI Results

BH_SW16	Drainage Line north of Haul Road and MIA	21-Mar-23	7.09	1562	33.3	4.2	78.9	1000	NR
BH_SW20	RP3 Outflow channel	22-Mar-23	5.24	216	25.3	5.53	84.6	138	NR
BH_PW02	Boundary Hill Pit Water	23-Mar-23	7.23	1629	29.5	5.54	94.4	1043	NR
BH_SW21	Gate Creek below Lake Gasteen	23-Mar-23	7.06	2034	29.5	5.72	34	1302	Slight green algae colour
BH_SW22	Unnamed Dam south of site on Gate Creek	23-Mar-23	7.78	1867	30.7	6.41	26.8	1195	Slight green algae colour

Notes:

MW	Monitoring Well	ORP	Oxidation-reduction potential
DO	Dissolved Oxygen (unable to be recorded due to probe malfunction)	mV	millivolts
mg/L	milligrams per litre	L	Litres
EC	Electrical Conductivity	TDS	Total Dissolved Solids (EC x 0.64)
µS _{cm} ⁻¹	microsiemens per centimetre	Operator	R. Lawrence/ R. Cooke
NR	Not Recorded		

			PFCA-10P								PFBS-10P								PFSA-10P								FISA-TOP				
			Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctanesulfonamide (PFOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtA)	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanesulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)		
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
			0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005
																	</														

EQI	TOC	Grainsize Distribution				PSD											
		Fines (<75 µm)	Sand (>75 µm)	Gravel (>2mm)	Cobbles (>6cm)	+75µm	+150µm	+300µm	+425µm	+600µm	+1180µm	+2.36mm	+4.75mm	+9.5mm	+19.0mm	+37.5mm	+75.0mm
NEMP (2020) Ecological (direct exposure)* NEMP (2020) Ecological (indirect exposure) NEMP (2020) HIL C - Public open space NEMP (2020) HIL D - Industrial/ commercial	Fraction Organic Carbon mg/ Kg	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0.02	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

PSI Results

SDG	SampleCode	Field_ID	LocCode	Sampled_Date
EB2119975	EB2119975014	BH_SED01	BH_SED01	15/07/2021
EB2119975	EB2119975015	BH_SED02	BH_SED02	15/07/2021
EB2119975	EB2119975016	BH_SED03	BH_SED03	15/07/2021
EB2119975	EB2119975017	BH_SED04	BH_SED04	15/07/2021

First Round DSI Results

SDG	SampleCode	Field_ID	LocCode	Sampled_Date
EB2226095	EB2226095037	BH_SED05	BH_SED05	31/08/2022
EB2226095	EB2226095036	BH_SED06	BH_SED06	31/08/2022
EB2226095	EB2226095038	BH_SED07	BH_SED07	1/09/2022

1.53	95	5	<1	5	4	3	2	1	<1	<1	<1	<1	<1	<1	<1	<1			
4.45	82	17	1	18	13	7	5	4	2	1	1	<1	<1	<1	<1	<1			
9.16	52	38	10	48	40	30	25	21	15	8	8	<1	<1	<1	<1	<1			

Station ID	Location	PECA										PTSS						PTSA						FTSA			
		Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctanesulfonamide (PFOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtF)	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutanoic acid (PFBS)	Perfluoropentanoic acid (PFPeS)	Perfluorohexanoic acid (PFHxS)	Perfluorooctanoic acid (PFOS)	Perfluorodecanoic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
Station value systems (99% reliably disturbed systems (95%))		0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0005	0.001	0.001	0.001	0.001
					<0.56																<0.07						
					19																	0.00023					
Station value systems (99% reliably disturbed systems (95%))					10																2						
																						0.13					
																						2					
Station ID	LocCode	Sampled_Date-Time																									
	BH01	17/08/2021																									
	MB08	17/08/2021	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0008	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0005	<0.0016	<0.0015	0.0033	<0.0005	<0.0003	<0.0005	<0.001	<0.001
	MB28	2/09/2022	0.005	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.002	0.007	<0.003	<0.001
	BH_LMB01	2/09/2022	<0.016	<0.0032	<0.0032	<0.0032	<0.0032	<0.0032	<0.0032	<0.0032	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.0032	<0.0032	<0.0035	<0.0032	0.0035	<0.0032	<0.0032	<0.003	<0.003	<0.003	<0.003
Station ID	LocCode	Sampled_Date-Time																									
	BH_LMB02	1/09/2022	<0.0397	0.0198	<0.0016	<0.0079	<0.0079	<0.0079	<0.0079	<0.0079	<0.0198	<0.0079	<0.02	<0.02	<0.0079	<0.0079	<0.0079	<0.0079	0.0611	0.0484	0.069	<0.0079	<0.0096	<0.0079	<0.008	<0.008	<0.008
	BH_LMB03	2/09/2022	<0.008	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.002	<0.002	<0.002	<0.002
	BH_LMB05	1/09/2022	<0.0389	0.0482	0.0794	<0.012	<0.0078	<0.0078	<0.0078	<0.0078	<0.0194	<0.0078	<0.019	<0.019	<0.019	<0.019	<0.0078	<0.0078	0.0249	0.0311	<0.1327	0.3134	<0.0078	<0.0078	<0.008	<0.008	<0.008
Station ID	LocCode	Sampled_Date-Time																									
	BH01	21/03/2023	<0.0128	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0006	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.0005	<0.0005	0.0047	<0.0017	<0.0017	<0.0005	<0.0005	<0.001	<0.007	<0.001	<0.001
	MB08	23/03/2023	<0.0039	<0.0008	<0.0008	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0020	<0.0005	<0.002	<0.001	<0.001	<0.001	<0.0005	<0.0005	<0.0008	0.0007	<0.0007	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001
	MB28	22/03/2023	<0.0157	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0079	<0.0031	<0.008	<0.008	<0.008	<0.008	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.003	<0.003	<0.003	<0.003
	BH_LMB01	22/03/2023	<0.0040	<0.0008	<0.0005	0.0008	<0.0005	<0.0005	<0.0008	<0.0008	<0.0020	<0.0005	<0.002	<0.002	<0.002	<0.002	<0.0005	<0.0008	<0.0005	<0.0005	<0.0029	<0.0005	<0.0005	<0.001	<0.001	<0.001	<0.001
Station ID	LocCode	Sampled_Date-Time																									
	BH_LMB02	21/03/2023	<0.0162	0.0187	0.0546	<0.0032	<0.0032	<0.0032	<0.0032	<0.0032	<0.0081	<0.0032	<0.008	<0.008	<0.008	<0.008	<0.0032	<0.0032	0.0757	0.0465	0.0582	<0.0032	<0.0032	<0.003	<0.003	<0.003	<0.003
	BH_LMB03	21/03/2023	<0.0156	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0078	<0.0031	<0.008	<0.008	<0.008	<0.008	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.0031	<0.003	<0.003	<0.003	<0.003
Station ID	LocCode	Sampled_Date-Time																									
	BH_LMB05	21/03/2023	0.392	1.68	1.13	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049	<0.0123	<0.0049	<0.012	<0.012	<0.012	<0.012	<0.0049	<0.0049	0.216	0.121	0.8877	<0.0049	<0.0049	<0.005	<0.006	<0.005	<0.005



*RPDs have only been considered where a concentration is greater than 1 times the EOL.

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

ATTENTION: THE FOLLOWING INFORMATION IS FOR THE USE OF THE PERSONNEL OF THE U.S. DEPARTMENT OF AGRICULTURE AND THE U.S. DEPARTMENT OF COMMERCE. IT IS NOT TO BE RELEASED TO THE PUBLIC.

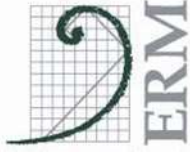


Table 9a - Quality Assurance / Quality Control Results - Soil and Sediment Duplicates
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

SDG	Field ID	EB2222597-AA BHL_MB02_7.0 29/07/2022	EB2222597-AA QS-01A 29/07/2022	RPD	B22-Au0013332 QS_01B 29/07/2022	RPD	EB2222597-AA BHL_CON_02_U 30/07/2022	EB2222597-AA QCON_01A 30/07/2022	RPD	B22-Au0013334 QCON_01B 30/07/2022
Chem_Group	ChemName	Units	EQL							
FTSA	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0005	<0.0005	NA	<0.0005	NA	<0.0005	NA	<0.005
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	mg/kg	0.0005	<0.0005	NA	<0.0005	NA	<0.0005	NA	<0.01
	8:2 Fluorotelomer sulfonate (8:2 FTS)	mg/kg	0.0005	<0.0005	NA	<0.0005	NA	<0.0005	NA	<0.005
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0005	<0.0005	NA	<0.0005	NA	<0.0005	NA	<0.005
PFAS Summations	Sum of PFHxS and PFOS	mg/kg	0.0002	<0.0002	NA	<0.0002	NA	0.0036	0.0015	<0.005
	Sum of PFAS (WA DER List)	mg/kg	0.0002	<0.0002	NA	<0.01	NA	0.0053	0.0019	<0.01
	Sum of PFAS	mg/kg	0.0002	<0.0002	NA	<0.0050	NA	0.0055	0.0019	<0.0050
PFCA	Perfluorobutanoic acid (PFBA)	mg/kg	0.001	<0.001	NA	<0.005	NA	<0.001	<0.001	NA
	Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorohexanoic acid (PFHxA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	0.0008	0.0004	<0.005
	Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorooctanoic acid (PFOA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorononanoic acid (PFNA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorodecanoic acid (PFDA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluoroundecanoic acid (PFUnA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorododecanoic acid (PFDoA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorotridecanoic acid (PFTriDA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
PFSA	Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.0005	<0.0005	NA	<0.005	NA	<0.0005	NA	<0.005
	Perfluorobutanesulfonic acid (PFBS)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	0.0004	<0.0002	<0.005
	Perfluoropentanesulfonic acid (PFPeS)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	0.0002	<0.0002	NA
	Perfluorohexanesulfonic acid (PFHxS)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	0.0018	0.0007	<0.005
	Perfluoroheptanesulfonic acid (PFHpS)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorooctanesulfonic acid (PFOS)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	0.0018	0.0008	<0.005
PFSS	Perfluorodecansulfonic acid (PFDS)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	Perfluorooctanesulfonamide (PFOSA)	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.0005	<0.0005	NA	<0.005	NA	<0.0005	<0.0005	NA
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.0005	<0.0005	NA	<0.01	NA	<0.0005	<0.0005	<0.01
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	mg/kg	0.0005	<0.0005	NA	<0.005	NA	<0.0005	<0.0005	NA
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.0005	<0.0005	NA	<0.005	NA	<0.0005	<0.0005	NA
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA
	N-Methyl perfluorooctane sulfonamidoacetic acid	mg/kg	0.0002	<0.0002	NA	<0.005	NA	<0.0002	<0.0002	NA

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 50 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x Et

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row

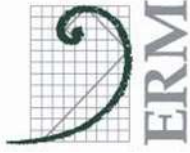


Table 9a - Quality Assurance / Quality Control Results - Soil and Sediment Duplicates
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

SDG Field ID Sampled Date/Time	EB2222597-AA BH_SB04_0.5 30/07/2022	EB2222597-AA QS-02A 30/07/2022	RPD	B22-Au0013333 QS_02B 30/07/2022	RPD	EB2222999-AA BH_SB06_0.25 2/08/2022	RPD	EB2222999-AA QS_03A 2/08/2022	RPD
Chem_Group	ChemName	Units	EQL						
PFSA	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0005						
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	mg/kg	0.0005						
	8:2 Fluorotelomer sulfonate (8:2 FTS)	mg/kg	0.0005						
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0005						
PFAS Summations	Sum of PFHxS and PFOS	mg/kg	0.0002						
	Sum of PFAS (WA DER List)	mg/kg	0.0002						
	Sum of PFAS	mg/kg	0.0002						
PFCA	Perfluorobutanoic acid (PFBA)	mg/kg	0.001						
	Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002						
	Perfluorohexanoic acid (PFHxA)	mg/kg	0.0002						
	Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0002						
	Perfluorooctanoic acid (PFOA)	mg/kg	0.0002						
	Perfluorononanoic acid (PFNA)	mg/kg	0.0002						
	Perfluorodecanoic acid (PFDA)	mg/kg	0.0002						
	Perfluoroundecanoic acid (PFUnA)	mg/kg	0.0002						
	Perfluorododecanoic acid (PFDoA)	mg/kg	0.0002						
	Perfluorotridecanoic acid (PFTriDA)	mg/kg	0.0002						
	Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.0005						
PFSA	Perfluorobutanesulfonic acid (PFBS)	mg/kg	0.0002						
	Perfluoropentane sulfonic acid (PFPeS)	mg/kg	0.0002						
	Perfluorohexanesulfonic acid (PFHxS)	mg/kg	0.0002						
	Perfluoroheptane sulfonic acid (PFHpS)	mg/kg	0.0002						
	Perfluorooctane sulfonic acid (PFOS)	mg/kg	0.0002						
	Perfluorodecane sulfonic acid (PFDS)	mg/kg	0.0002						
PFSS	Perfluorooctanesulfonamide (PFOSA)	mg/kg	0.0002						
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.0005						
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.0005						
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	mg/kg	0.0005						
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.0005						
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	mg/kg	0.0002						
	N-Methyl perfluorooctane sulfonamidoacetic acid	mg/kg	0.0002						

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 50 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x Et

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row

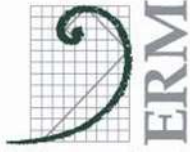


Table 9a - Quality Assurance / Quality Control Results - Soil and Sediment Duplicates
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Chem_Group	ChemName	Units	EQL	Field ID Sampled Date/Time	EB2226095 BHL_SED07 1/09/2022	EB2226095 QSED_02A 1/09/2022	B22-Se0015626 QSED_02B 1/09/2022	EB2309890 BHL_SED08_01 23/03/2023	EB2309890 BHL_QS01A 23/03/2023	978522 BHL_QS01B 23/03/2023	RPD
FTSA	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0005		<0.0005	<0.0005	<0.005	<0.0005	<0.0005	0.005	NA
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	mg/kg	0.0005		<0.0005	<0.0005	<0.01	0.0018	0.0017	0.01	139
	8:2 Fluorotelomer sulfonate (8:2 FTS)	mg/kg	0.0005		<0.0005	<0.0005	<0.005	0.0005	<0.0005	0.005	164
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0005		<0.0005	<0.0005	<0.005	<0.0005	<0.0005	0.005	NA
PFAS Summations	Sum of PFHxS and PFOS	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0111	0.0102	8	26
	Sum of PFAS (WA DER List)	mg/kg	0.0002		<0.0002	<0.0002	<0.01	0.0169	0.0153	10	15
	Sum of PFAS	mg/kg	0.0002		<0.0002	<0.0002	<0.0050	0.0181	0.0164	10	93
PFCA	Perfluorobutanoic acid (PFBA)	mg/kg	0.001		<0.001	<0.001	<0.005	<0.001	<0.001	NA	NA
	Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0006	0.0006	0	<0.005
	Perfluorohexanoic acid (PFHxA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.001	0.001	0	<0.005
	Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0004	0.0003	29	<0.005
	Perfluorooctanoic acid (PFOA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0004	0.0003	29	<0.005
	Perfluorononanoic acid (PFNA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	Perfluorodecanoic acid (PFDA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	Perfluoroundecanoic acid (PFUnA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	Perfluorododecanoic acid (PFDoA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	Perfluorotridecanoic acid (PFTriDA)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.0005		<0.0005	<0.0005	<0.005	<0.0005	<0.0005	NA	<0.005
PFSA	Perfluorobutanesulfonic acid (PFBS)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0011	0.0012	9	<0.005
	Perfluoropentane sulfonic acid (PFPeS)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0008	0.0007	13	<0.005
	Perfluorohexanesulfonic acid (PFHxS)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0061	0.0046	28	0.0063
	Perfluoroheptane sulfonic acid (PFHpS)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	0.0004	0.0004	0	<0.005
	Perfluorooctane sulfonic acid (PFOS)	mg/kg	0.0002		0.0016	0.0017	<0.005	0.005	0.0056	11	0.0082
PFSS	Perfluorodecane sulfonic acid (PFTDS)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	Perfluorooctanesulfonamide (PFOS-A)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.005
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.0005		<0.0005	<0.0005	<0.005	<0.0005	<0.0005	NA	<0.005
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.0005		<0.0005	<0.0005	<0.01	<0.0005	<0.0005	NA	<0.005
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	mg/kg	0.0005		<0.0005	<0.0005	<0.01	<0.0005	<0.0005	NA	<0.005
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.0005		<0.0005	<0.0005	<0.005	<0.0005	<0.0005	NA	<0.01
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et)	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.01
	N-Methyl perfluorooctane sulfonamidoacetic acid	mg/kg	0.0002		<0.0002	<0.0002	<0.005	<0.0002	<0.0002	NA	<0.01

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 50 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL)
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row

Environmental Resources Management Australia Pty Ltd

Environmental Resources Management Australia Pty Ltd



Table 9b - Quality Assurance / Quality Control Results - Surface Water and Groundwater Duplicates
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Chem_Group	ChemName	Units	EQL	ER2306890 BH_SW22	ER2306890 BH_QW02A	978522 BH_QW02B	RPD
PFSA	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	NA
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.001	<0.001	0.005	13
	8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	NA
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	NA
PFAS Summations	Sum of PFHxS and PFOS	µg/L	0.0002	0.107	0.0887	19	0.082
	Sum of PFAS (WA DER Ltd)	µg/L	0.0002	0.206	0.216	5	0.219
	Sum of PFAS	µg/L	0.0002	0.225	0.228	1	0.227
							1
PFCA	Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.01	<0.008	NA	0.019
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	0.0416	0.044	6	0.034
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	0.0274	0.0423	43	0.036
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	0.0202	0.0308	42	0.009
	Perfluorooctanoic acid (PFOA)	µg/L	0.0005	0.0098	0.0107	9	0.004
	Perfluorononanoic acid (PFNA)	µg/L	0.0005	0.0042	0.0037	13	0.002
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.0005	<0.0005	NA	<0.001
	Perfluoroundecanoic acid (PFUdA)	µg/L	0.0005	<0.0008	<0.0005	NA	<0.001
	Perfluorododecanoic acid (PFDDA)	µg/L	0.0005	<0.0008	<0.0005	NA	<0.001
	Perfluorotridecanoic acid (PFTDA)	µg/L	0.0005	<0.0008	<0.0005	NA	<0.001
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	<0.002	<0.0005	NA	<0.001
							NA
PFSA	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.0085	<0.0005	NA	0.008
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	0.0119	0.0057	70	0.004
	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	0.0614	0.0396	43	0.056
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	0.003	0.0017	55	0.002
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	0.0458	0.0491	7	0.026
	Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	<0.0005	<0.0005	NA	<0.001
							NA
							NA
PFSS	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.0008	<0.0005	NA	<0.005
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.002	<0.001	NA	<0.005
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.002	<0.001	NA	<0.005
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.002	<0.001	NA	<0.005
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.002	<0.001	NA	<0.005
	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtI)	µg/L	0.0005	<0.0008	<0.0005	NA	<0.005
	N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	<0.0008	<0.0005	NA	<0.005
							NA
Other	Alkalinity (total) as CaCO3	mg/l	1				
	Anions Total	mg/L	0.01				
	Bicarbonate as CaCO3	mg/l	1				
	Carbonate as CaCO3	mg/l	1				
	Cations Total	mg/L	0.01				
	Chloride	mg/l	1				
	Ionic Balance	%	0.01				
	Sodium (Filtered)	mg/l	1				
	Hydroxide as CaCO3	mg/l	1				
	Total Dissolved Solids @180°C	mg/l	10				
	Sulfate as SO4 - Turbidimetric (Filtered)	mg/l	1				
	Calcium (Filtered)	mg/l	1				
	Magnesium (Filtered)	mg/l	1				
	Potassium (Filtered)	mg/l	1				

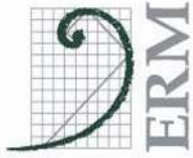


Table 10 - Quality Assurance / Quality Control Results - Field Blanks
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

SDG	Field ID	Sampled_Date/Time	Chem_Name	Units	EQI	EB2119975 RINSATE 1 13/07/2021	EB2119975 RINSATE 3 15/07/2021	EB2225597-AA W_RB01 28/07/2022	EB2225597-AA W_RB02 29/07/2022	EB2222999-AA W_RB03 1/08/2022	EB2226095 W_RB16 31/08/2022	EB2226095 W_RB17 31/08/2022	EB2226095 W_RB18 31/08/2022	EB2226095 W_RB19 31/08/2022
Sample Type						Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate
FTSA			Hydroxide as CaCO3	mg/l	1									
			Total Dissolved Solids @180°C	mg/l	10									
			4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PFAS Summations			10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			Sum of PFHxS and PFOS	µg/L	0.0002	<0.0002	<0.0002	0.0036	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
			Sum of PFAS (WA DER List)	µg/L	0.0002	<0.0002	0.0036	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
			Sum of PFAS	µg/L	0.0002	-	0.0036	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
				µg/L	0.0002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PFCA			Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
			Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorooctanoic acid (PFOA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorononanoic acid (PFNA)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorodecanoic acid (PFDA)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorotridecanoic acid (PFTriDA)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PFSA			Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	<0.0002	<0.0002	0.0036	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
PFSS			Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0005	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
				µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
			N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
			N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
		N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005



Table 10 - Quality Assurance / Quality Control Results - Field Blanks
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Chem_Group	ChemName	Units	EQI	Field ID	Sampled_Date/Time	Sample Type	SDG	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095	ER2226095
	Hydroxide as CaCO3	mg/L	1																
	Total Dissolved Solids @180°C	mg/L	10																
FTSA	4,2 Fluorotelomer sulfonic acid (4,2 FTS)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	6,2 Fluorotelomer Sulfonate (6,2 FTS)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	8,2 Fluorotelomer sulfonate (8,2 FTS)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	10,2 Fluorotelomer sulfonic acid (10,2 FTS)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PFAS Summations	Sum of PFHxS and PFO5	µg/L	0.0002					<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Sum of PFAS (WA DER List)	µg/L	0.0002					<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Sum of PFAS	µg/L	0.0002					<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
PPCA	Perfluorobutanoic acid (PFBA)	µg/L	0.002					<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorooctanoic acid (PFOA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorononanoic acid (PFNA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorododecanoic acid (PFDoA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorotridecanoic acid (PFTriDA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005					<0.0008	<0.0008	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007	<0.0007
PFSA	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Perfluorooctane sulfonic acid (PFO5)	µg/L	0.0002					<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
PFSS	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et)	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005					<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005



Table 10 - Quality Assurance / Quality Control Results - Field Blanks
Batchfire Boundary Hill Site
2022-2023 PFAS DSI - 0637703

Chem_Group	ChemName	Units	EQL	EB2309890		EB2309890		EB2309890		EB2309890		EB2309890		EB2309890	
				Field ID	Sample Type	Field ID	Sample Type	Field ID	Sample Type	Field ID	Sample Type	Field ID	Sample Type	Field ID	Sample Type
PFSA	Hydroxide as CaCO3	mg/l	1												
	Total Dissolved Solids @180°C	mg/l	10												
	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001												
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001												
	8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001												
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001												
PFAS Summations	Sum of PFHxS and PFCs	µg/L	0.0002												
	Sum of PFAS (WA DER List)	µg/L	0.0002												
	Sum of PFAS	µg/L	0.0002												
PFCA	Perfluorobutanoic acid (PFBA)	µg/L	0.002												
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005												
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005												
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005												
	Perfluorooctanoic acid (PFOA)	µg/L	0.0005												
	Perfluorononanoic acid (PFNA)	µg/L	0.0005												
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005												
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005												
	Perfluorododecanoic acid (PFDoA)	µg/L	0.0005												
	Perfluorotridecanoic acid (PFTriDA)	µg/L	0.0005												
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005												
PFSA	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005												
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005												
	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005												
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005												
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002												
	Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005												
PFSS	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005												
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001												
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001												
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001												
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001												
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005												
	N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005												

Year of Installation	Casing Diameter (mm)	TOC Elevation (mRL)	TOC (mags)	Ground Surface Elevation (mRL)	Depth to Bottom-of-Well (mbgs)	Depth to Top-of-Well Screen (mbgs)	Lithology of Screen
Unknown	100	290.150	0.24	289.910	17.3	1.4	Sandstone, Callide Coal M
0-Jun-16	50	292.379	0.800^	291.579	36	30	Siltstone and sandstone (M
07-Oct-14	50	269.330	0.914	268.416	20	17	Silty Sandstone (Monc
Unknown	50	301.602	0.500^	301.102	44.45	36	No Log, GWLDB ind
Unknown	50	304.320	0.300^	304.020	13.67	10	No Log, GWLDB ind
5-Aug-22	50	297.095	-0.100	297.195	15	9.5	Weathered Siltstone, fine to me
3-Aug-22	50	261.887	1.099	260.788	30	24	Rock, hard, Youlambie
2-Aug-22	50	257.557	1.068	256.489	9.2	6.2	Rock, hard, Youlambie
1 Aug-2022	50	300.449	1.005	299.444	17	14	Gravelly clayey SAND (Qua

ociates (2014) Summary of EA Borehole Drilling, Golders Associates (2016) Summary of Groundwater Bore Drilling at DC01 and HUT01, Batchfire (2021) Groundwater Level Database (GWLDB), as provided

ound surface
ound surface
Level, elevation levels sourced from GWLDB
lated from ground surface elevation and TOC (mags)
measurements were not provided, estimations from field observations were used
MB08 and MB10 not provided in the GWLDB. Elevations provided are assumed to be ground surface.

Location	Total Measured Depth (mbTOC)	July 2021 Gauging	SWL (mbTOC)	August 2021 Gauging	SWL (mbTOC)	February 2022 Gauging	SWL (mbTOC)	August/September 2022 Gauging	SWL (mbTOC)	March 2023 Gauging	SWL (mbTOC)	Change in groundwater level from August/September 2022 to March 2023
9	36.000	17-Jul-21	27.580	16-Aug-21	27.630	08-Feb-22	27.540	02-Sep-22	30.221	24-Mar-23	27.450	2.771
2	44.000	13-Jul-21	18.205	16-Aug-21	18.280	08-Feb-22	18.675	02-Sep-22	18.665	27-Mar-23	18.750	-0.085
0	16.780	--	--	--	--	08-Feb-22	15.540	02-Sep-22	13.346	24-Mar-23	15.740	-2.394
0	20.000	--	--	16-Aug-21	7.230	09-Feb-22	6.090	02-Sep-22	4.831	24-Mar-23	6.065	-1.234
0	13.670	--	--	16-Aug-21	8.070	08-Feb-22	7.470	02-Sep-22	7.098	28-Mar-23	7.600	-0.502
5	14.990	--	--	--	--	--	--	29-Aug-22	11.700	28-Mar-23	11.940	-0.24
7	31.37	--	--	--	--	--	--	29-Aug-22	27.868	24-Mar-23	30.150	-2.282
7	10.106	--	--	--	--	--	--	29-Aug-22	8.139	24-Mar-23	8.307	-0.168
9	18.045	--	--	--	--	--	--	29-Aug-22	14.713	27-Mar-23	16.500	-1.787

/R. Cooke

mbTOC: metres below top of casing

mRL: metres Relative Level, elevation levels sourced from GWLDB

See Table 1 Notes regarding elevation assumptions and sources

ground surface

Date	pH	EC (µScm)	Temp (°C)	ORP (mV)	DO (mg/L)	TDS (mg/L)	Comments
10-Feb-22	6.77	2,390	23.9	24.1	0.70	1,530	Clear, d
02-Sep-22	6.61	2,302	22.8	89.5	0.21	1,473	
24-Mar-23	--	--	--	--	--	--	Insufficient water in
17-Aug-21	6.93	6,342	20.5	-3.2	1.3	4,059	Slightly turbid at
10-Feb-22	6.56	7,444	25.5	0.9	0.8	4,764	Clear water
02-Sep-22	6.61	5,031	21.6	-13.1	0.79	3,220	
24-Mar-23	6.39	7,504	26.8	-64.0	0.99	4,803	slightly
17-Aug-21	6.70	4,994	24.4	-137.1	0.7	3,196	Black susp
10-Feb-22	6.60	6,458	29.2	-155.4	0.6	4,133	Clear water
02-Sep-22	6.71	5,329	21.7	-158.4	1.38	3,411	
24-Mar-23	6.39	5,811	27.2	-217.0	0.92	3,719	H2S/organic odo
17-Aug-21	5.78	1,832	24.4	32.9	0.90	1,172	Minor sediment at bot
10-Feb-22	5.61	2,293	27	3.2	0.60	1,468	Clear water
02-Sep-22	5.54	2,396	24.2	94.0	1.14	1,533	
27-Mar-23	5.48	2,048	27.6	34.0	2.00	1,311	Clear water
17-Aug-21	5.95	2,493	23.5	-127.8	0.9	1,596	Yellow, strong hydr
10-Feb-22	6.13	2,208	26	-176.1	0.7	1,413	Yellow colour, h
02-Sep-22	6.26	2,241	25.3	-95.4	1.43	1,434	
28-Mar-23	5.70	2,107	31.7	-186.0	--	1,348	
02-Sep-22	4.48	5,557	23.2	80.7	2.35	3,556	
28-Mar-23	4.82	5,521	26.8	55.0	2.50	3,533	
29-Aug-22	--	--	--	--	--	--	Insufficient water in
24-Mar-23	--	--	--	--	--	--	Insufficient water in
02-Sep-22	7.45	2,292	20.5	30.7	1.10	1,467	
24-Mar-23	6.66	2,870	25.7	20.0	1.26	1,837	clear
02-Sep-22	3.13	2,417	24.5	244.5	2.30	1,547	
27-Mar-23	4.87	2,210	28.0	36.0	2.21	1,414	Highly s

Monitoring Well

Dissolved Oxygen

Milligrams per litre

Electrical Conductivity

ORP

mV

L

TDS

Oxidation-reduction potential

millivolts

Litres

Total Dissolved Solids (EC x 0.64)

ID	Date	pH	EC (µScm)	Temp (°C)	ORP (mV)	DO	TDS (mg/L)	Comments
	01-Sep-22	8.05	1665	16.2	107.4	5.38	1066	Clear water
	01-Sep-22	7.77	1286	20.7	61.6	6.75	823	Clear water, Ghost
	01-Sep-22	7.68	1822	19.0	95.1	2.91	1166	Clear water
TDSI Results								
	29-Mar-23	7.5	1404	27.4	14.3	10.56	899	First flush of water wa
2	29-Mar-23	7.48	1499	26.6	12.2	7.57	959	SW from Ghost
2	29-Mar-23	7.43	1916	28.4	9.2	5.27	1226	From tank, pump

Dissolved Oxygen
milligrams per litre
Electrical Conductivity
microsiemens per centimetre
Not recorded

ORP
mV
L
TDS
Operator

Oxidation-reduction potential
millivolts
Litres
Total Dissolved Solids (EC x 0.64)
R.Lawrence/ R. Cooke

Location ID	Site Location	Date	pH	EC (µS/cm)	Temp (°C)	ORP (mV)	DO (mg/L)	TDS (mg/L)	Comments
1st Round Results									
CM-SW01	Dunn Creek Dam	14-Jul-21	7.91	1,487	19.6	-45.5	-	952	No recordings
CM-SW02	Rail Loop Pond	14-Jul-21	7.31	438	21.5	-14.7	-	280	No recordings
CM-SW03	Lake McCauley	14-Jul-21	7.37	1269	21.1	-13.6	-	812	No recordings
CM-SW04	Southern Holding Pond	14-Jul-21	6.74	635	18.4	17.6	4.14	406	No recordings
CM-SW05	Northern Holding Pond	14-Jul-21	7.43	1334	18.4	103.3	5.28	854	No recordings
CM-SW06	Dunn Creek Dam	07-Dec-21	7.82	1,154	29.1	132.1	7.47	739	Slightly cloudy and slight brown colour
CM-SW07	Dunn Creek Dam	07-Dec-21	8.82	1,170	30.4	137.4	6.60	749	Cloudy and grey
CM-SW08	Rail Loop Pond	07-Dec-21	7.81	1,593	26.9	177.1	7.46	1,020	Cloudy and grey
CM-SW09	Rail Loop Pond	07-Dec-21	7.81	1,607	27.4	173.7	5.15	1,028	Slightly cloudy and grey
CM-SW10	Lake McCauley	07-Dec-21	8.72	1,171	30.9	131.2	5.22	749	Slightly cloudy and some suspended organic solids
CM-SW11	Lake McCauley	07-Dec-21	8.37	1,154	30.2	137.9	5.45	739	Slightly cloudy and some suspended organic solids
CM-SW12	Southern Holding Pond	07-Dec-21	8.31	403	32.7	153.4	3.05	258	Very slightly green and algae present
CM-SW13	Drainage line west of MIA (near 1904)	07-Dec-21	8.03	707	27.4	149.7	5.13	452	Slightly green and algae present
CM-SW14	East Dam	07-Dec-21	8.03	1,204	29.1	121.8	4.20	771	Clear
CM-SW15	East Dam	07-Dec-21	8.59	1,232	30.4	102.6	4.05	788	Clear
TG_SW01	Trap Gully, Ghost Ryders Dam	07-Dec-21	8.30	1,340	32.3	121.0	4.65	858	Clear
TH_SW01	The Hut Pit Water	10-Feb-22	7.31	2,266	33.2	89.0	6.45	1,450	Clear, wind causing small surface waves
2nd Round DSI Results									
CM_PW01	Dunn Creek Pit Water	01-Sep-22	7.59	1443	18.0	62.8	7.26	924	Clear water
CM_PW02	Dunn Creek Pit Water	01-Sep-22	7.7	1708	17.9	68.3	7.26	1093	Slightly turbid, algae present
CM_SW11	Lake McCauley	31-Aug-22	7.48	1711	22.1	65.8	5.81	1095	NR
CM_SW16	Drainage line west of MIA (near 1904)	31-Aug-22	6.56	767	16.9	62.1	2.57	491	NR
CM_SW19	Bathhouse Sediment Basin	26-Jul-22	7.88	1386	21.4	-70.0	6.85	887	Slightly turbid water
CM_SW21	Dunn Creek below the Dunn Creek Dam	02-Aug-22	6.97	955	21.6	46.8	5.58	611	Clear water
CM_SW22	East Dam	26-Jul-22	7.21	1375	19.9	-43.6	7.26	880	Clear water
TG_PW01	Trap Gully, Pit Water	01-Sep-22	5.98	902	22.1	62.0	0.92	577	Clear water, some iron floc
TG_PW04	Trap Gully, Haul Road Runoff	02-Sep-22	7.68	734	23.5	82.2	5.07	470	Silty, turbid water
TH_SW02	The Hut, Oaky Creek Diversion Dam	26-Jul-22	7.81	406	21.8	57.0	7.78	260	Clear water
3rd Round DSI Results									
TG_SW05	Trap Gully	23-Mar-23	8.17	539	31.8	10.5	5.74	345	Slightly turbid
CM_SW26	Drainage line west of MIA (near 1904)	24-Mar-23	6.67	625	28.9	20.9	3.44	400	Turbid water, organic mater present
CM_SW20	Magazine Dam	24-Mar-23	7.4	1462	29.6	27.7	4.02	936	slightly turbid water
CM_SW23	Southern Holding Pond	24-Mar-23	6.46	329	27.8	15.1	2.27	211	Green tinge to water, algae present
CM_PW02	Dunn Creek Pit Water	27-Mar-23	7.83	991	27.5	2.8	5.24	634	Green tinge to water, algae present
CM_PW03	Dunn Creek Pit Water	27-Mar-23	7.52	1524	26.8	17.3	5.3	975	Clear water
CM_SW27	East Dam	27-Mar-23	8.04	1682	30.4	16.5	4.81	1076	Clear water
CM_SW24	Northern Holding Pond	27-Mar-23	7.73	1837	33.3	21.2	2.98	1176	slightly turbid water
CM_SW25	Bathhouse Sediment Basin	28-Mar-23	8.02	1854	33.0	26.3	5.58	1187	Silty, turbid water
CM_Overpass	Overpass Dam	07-Jul-23	7.88	1855	22.4	NR	NR	1187	Slightly turbid water

Notes:

DO

Dissolved Oxygen

ORP

Oxidation-reduction potential

Sample_ID	LocCode	Sample_Depth_Rar	Sampled_Date/Time	PFCA										PFOS								PFSA								FISA			
				Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorohexafluoro acid (PFHfA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctanesulfonamide (PFOSA)	N-Methyl perfluorooctane sulfonamide (MeFOsA)	N-Ethyl perfluorooctane sulfonamide (EtFOsA)	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et)	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorohexafluoro sulfonic acid (PFHfS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	10:2 Fluorotelomer sulfonate (10:2 FTS)		
* 2 trial	CM_HA01	0.0-0.1	27/03/2023	<0.001	0.0008	0.0003	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA02	0.0-0.1	27/03/2023	<0.001	0.0007	0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0006	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA03	0.0-0.1	28/03/2023	<0.001	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA03	0.3-0.4	28/03/2023	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA04	0.5-0.15	29/03/2023	<0.001	0.0076	0.0063	0.0063	0.0062	0.0007	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0006	<0.0002	<0.0004	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
* 2 trial	CM_HA05	0.0-0.1	24/03/2023	<0.001	0.0005	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA05	0.35-0.45	24/03/2023	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA06	0.0-0.1	28/03/2023	<0.001	0.0009	0.0006	0.0005	0.0006	0.0016	0.0006	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA06	0.35-0.45	28/03/2023	<0.001	0.0009	0.0005	0.0006	0.0007	0.0014	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA07	0.0-0.1	29/03/2023	<0.001	0.0051	0.0148	0.0021	0.0055	0.0005	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
* 2 trial	CM_HA08	0.0-0.1	29/03/2023	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA08	0.3-0.4	29/03/2023	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA09	0.0-0.1	28/03/2023	<0.001	0.0003	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA12	0.1-0.2	7/07/2023	<0.001	0.002	0.0011	0.0007	0.0005	0.0003	<0.0002	<0.0002	0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	CM_HA12	0.5-0.6	7/07/2023	<0.001	0.0026	0.0019	0.0011	0.0007	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

[illegible]

	TOF	TOC	Grainsize Distribution				PSD											
			Fines (<75 µm)	Sand (>75 µm)	Gravel (>2mm)	Cobbles (>6cm)	75µm	150µm	300µm	425µm	600µm	1180µm	2.36mm	4.75mm	9.5mm	19.0mm	37.5mm	75.0mm
EQUL	Total OrganoFluorine	mg/ kg	1	0.1	0.02	%	1	1	1	1	1	1	1	1	1	1	1	1
	Moisture Content	%				%	1	1	1	1	1	1	1	1	1	1	1	1
	Fraction Organic Carbon	mg/ kg				%	1	1	1	1	1	1	1	1	1	1	1	1
						%	1	1	1	1	1	1	1	1	1	1	1	1
NEMP (2020) Ecological (direct exposure)																		
NEMP (2020) Ecological (indirect exposure)																		
NEMP (2020) HIL C - Public open space																		
NEMP (2020) HIL D - Industrial/ commercial																		

PSI Results

SDG	SampleCode	Field_ID	LocCode	Sampled_Date-Time
EB2120199	EB2120199025	CM - SED01	CM_SED01	14/07/2021
EB2120199	EB2120199026	CM - SED02	CM_SED02	14/07/2021
EB2120199	EB2120199027	CM - SED03	CM_SED03	14/07/2021
EB2136027	EB2136027014	TG_SED01	TG_SED01	7/12/2021
EB2136027	EB2136027015	TG_SED02	TG_SED02	7/12/2021

First and Second Round DSI Results

SDG	SampleCode	Field_ID	LocCode	Sampled_Date-Time
EB2226315	EB2226315038	CM_SED04	CM_SED04	31/08/2022
EB2223623	EB2223623042	CM_SED05	CM_SED05	8/08/2022
EB2223623	EB2223623071	CM_SED06	CM_SED06	8/08/2022
EB2226315	EB2226315039	CM_SED07	CM_SED07	31/08/2022
EB2222999-AB	EB2222999040	CM_SED08	CM_SED08	27/08/2022
EB2222597-AB	EB2222597074	CM_SED_09	CM_SED09	26/07/2022
EB2222597-AB	EB2222597075	CM_SED10	CM_SED10	26/07/2022
EB2223623	EB2223623072	CM_TCSED03	CM_TCSED03	8/08/2022
EB2223623	EB2223623073	CM_TCSED04	CM_TCSED04	8/08/2022
EB2223623	EB2223623074	CM_TCSED05	CM_TCSED05	8/08/2022
EB2222597-AB	EB2222597073	TH_SED_01	TH_SED01	26/07/2022
EB2320815	EB2320815001	CM_WEIR	CM_WEIR	7/07/2023

ID	LocCode	Sampled_Date-Time	PFCA-TOP										PFSS-TOP							PFSA-TOP							FTSA-TOP					
			Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorooheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctanesulfonamide (PFOSA)	N-Methyl perfluorooctanesulfonamide (MeFOSA)	N-Ethyl perfluorooctanesulfonamide (EtFOSA)	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctanesulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctanesulfonamidoacetic acid (Et)	N-Methyl perfluorooctanesulfonamidoacetic acid	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluorooheptanesulfonic acid (PFHpS)	Perfluorooctanesulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)		
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

ID	LocCode	Sampled_Date-Time	0.006	0.0118	0.0059	0.0031	0.0026	0.002	0.0016	0.0008	0.0005	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005
IED01	CM_SED01	14/07/2021																											
IED02	CM_SED02	14/07/2021	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
IED03	CM_SED03	14/07/2021	<0.001	0.0027	0.0015	0.0013	0.0009	0.0008	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
IED01	TC_SED01	7/12/2021	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
IED02	TC_SED02	7/12/2021	<0.001	0.0007	<0.0002	0.0006	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

ID	LocCode	Sampled_Date-Time	<0.001	0.0015	0.0009	0.0003	0.0003	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
IED05	CM_SED05	8/08/2022	<0.001																										
SED_09	CM_SED_09	26/07/2022	<0.001	0.0004	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
TCSED03	CM_TCSED03	8/08/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
TCSED04	CM_TCSED04	8/08/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
TCSED05	CM_TCSED05	8/08/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

PFCA-TOP										PFSS-TOP						PFSA-TOP						FISA-TOP							
LocCode	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluorohexanoic acid (PFHxA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctanesulfonamide (PFOSA)	N-Ethyl perfluorooctane sulfonamide (MeFOA)	N-Methyl perfluorooctanesulfonamide (MeFOA)	N-Ethyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et)	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanesulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	
0.1	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.05	0.05	0.05	0.05	0.05	0.05
0.56																					0.07								
19																							0.00023						
220																							2						
70																						2							
0.03	0.084	0.099	0.017	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	0.006	<0.002	0.012	<0.002	<0.005	<0.005	<0.005	<0.005
0.71	1.66	1.48	0.528	0.258	0.05	0.012	<0.01	<0.01	<0.01	<0.01	<0.025	<0.01	<0.025	<0.025	<0.025	<0.025	<0.01	<0.01	0.116	0.077	0.453^	0.026	0.836^	0.013	<0.01	0.013	<0.01	<0.01	<0.01
0.02	0.665	0.041	0.012	0.007	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.028	0.028	0.016	<0.002	0.662^	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.4	1.67	0.778	0.196	0.122	0.027	0.005	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	0.035	0.03	0.12^	0.008	0.149^	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.18	0.53	0.338	0.156	0.072	0.021	0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	0.004	0.009	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	0.038	0.027	0.008	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	0.013	0.009	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
0.01	0.002	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
0.01	0.06	0.03	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
<0.1	0.05	0.05	0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	0.04	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
0.16	0.382	0.181	0.101	0.055	0.015	0.004	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	0.021	0.017	0.115	0.012	0.289^	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.04	0.089	0.046	0.018	0.008	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	0.003	0.003	0.007	<0.002	0.015	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.02	0.046	0.023	0.011	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.006	<0.002	0.021	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.02	0.029	0.015	0.007	0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.004	<0.002	0.01	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.02	0.008	0.004	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
<0.01	0.015	0.007	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005
0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002																				

Location	Sampled Date-Time	PFCA										PFOS						PFSA						FTSA						
		Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDa)	Perfluoroundecanoic acid (PFUnA)	Perfluorododecanoic acid (PFDoA)	Perfluorotridecanoic acid (PFTriDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctanesulfonamide (PFOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutanesulfonic acid (PFBS)	Perfluoropentanesulfonic acid (PFPeS)	Perfluorohexanesulfonic acid (PFHxS)	Perfluoroheptanesulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer Sulfonate (6:2 FTS)	8:2 Fluorotelomer sulfonate (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	
on value systems (99%) ately disturbed systems (95%)																														
Location	Sampled Date-Time	LocCode																												
001	17/08/2021	DC01	<0.004	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.002	<0.0008	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	<0.001
002	17/08/2021	DC02	<0.004	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.002	<0.0008	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	<0.001
003	17/08/2021	MB10	0.115	0.916	0.133	0.356	0.0356	<0.0008	<0.0008	<0.0008	<0.002	<0.0008	<0.002	<0.002	<0.002	<0.002	<0.002	0.001	<0.0008	0.0109	0.0101	0.0483	0.0054	0.156^A	<0.0008	<0.0008	<0.001	0.217	0.006	<0.001
004	17/08/2021	MB12	0.364	1.35	0.454	1	0.2	<0.0032	<0.0032	<0.0032	<0.008	<0.0032	<0.008	<0.008	<0.008	<0.008	<0.008	<0.0032	<0.0032	0.117	0.124	0.604^A	0.0832	0.882^A	<0.0032	<0.0032	<0.003	0.531	0.039	<0.001
																					</									

PFCA-TOP										PFSS-TOP							PFSA-TOP						FISA-TOP																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								</

ation value systems (99%)
derately disturbed systems (95 %)*

SampleCode	LocCode	Sampled_Date-Time	
123606001	DC01	17/08/2021	
123606002	DC02	17/08/2021	
123606003	MB10	17/08/2021	
123606004	MB12	17/08/2021	

SampleCode	LocCode	Sampled_Date-Time	
2029901001	DC01	10/02/2022	
2029901002	DC02	10/02/2022	
2029901003	MB10	10/02/2022	
2029901004	MB12	10/02/2022	

SampleCode	LocCode	Sampled_Date-Time	
2299296001	CM_MBI5	31/08/2022	
2299296002	CM_MBI8	31/08/2022	
2299296003	CM_MBI9	31/08/2022	

SampleCode	LocCode	Sampled_Date-Time	
309891014	CM_MBI5	28/03/2023	
309891042	CM_MBI8	24/03/2023	
309891010	CM_MBI9	27/03/2023	

SDG		EB2120199	EB2120199	812346	EB2222999-7
Field ID	Field ID	CM - FTA - 05 (0.5)	QS - 02A	QS-02B	CM_MB19_0
Sampled Date/Time	Sampled Date/Time	13/07/2021	13/07/2021	13/07/2021	3/08/2022

ChemName	Units	EQL						
Sum of PFHxS and PFOS	mg/kg	0.0005	<0.005	<0.0026	0	<0.005	0	<0.0005
	mg/kg	0.0005	<0.005	<0.0026	0	<0.01	0	<0.0005
	mg/kg	0.0005	<0.005	0.0072	NA	<0.005	0	<0.0005
	mg/kg	0.0005	<0.005	<0.0026	0	<0.005	0	<0.0005
Moisture	%	0.1	NA	NA		NA		11.7
Sum of PFHxS and PFOS	mg/kg	0.0002	3.45	0.86	120	3.4083	1	0.0011
	mg/kg	0.0002	3.46	0.909	117	3.4143	1	0.0027
	mg/kg	0.0002	3.49	1.09	105	3.4343	2	0.0027
Sum of PFAS (WA DER List)	mg/kg	0.001	<0.025	<0.013	0	<0.005	0	<0.001
	mg/kg	0.0002	0.0059	0.0031	62	<0.005	17	0.0006
	mg/kg	0.0002	<0.005	0.0042	0	<0.005	0	0.0004
	mg/kg	0.0002	<0.005	0.007	33	<0.005	0	0.0003
	mg/kg	0.0002	0.0086	0.0239	94	0.006	36	0.0003
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0005	<0.0125	<0.0064	0	<0.005	0	<0.0005
	mg/kg	0.0002	<0.005	0.0033	0	<0.005	0	<0.0002
	mg/kg	0.0002	<0.005	0.0075	40	<0.005	0	<0.0002
Sum of PFAS (WA DER List)	mg/kg	0.0002	0.0113	0.208	179	0.0083	31	<0.0002
	mg/kg	0.0002	0.0242	0.172	151	0.02	19	<0.0002
	mg/kg	0.0002	3.44	0.652	136	3.4	1	0.0011
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0002	<0.005	<0.0026	0	<0.005	0	<0.0002
	mg/kg	0.0005	<0.0125	<0.0064	0	<0.005	0	<0.0005
	mg/kg	0.0005	<0.0125	<0.0064	0	<0.005	0	<0.0005
	mg/kg	0.0005	<0.0125	<0.0064	0	<0.005	0	<0.0005
	mg/kg	0.0005	<0.0125	<0.0064	0	<0.005	0	<0.0005
	mg/kg	0.0002	<0.005	<0.0026	0	<0.01	0	<0.0002
	mg/kg	0.0002	<0.005	<0.0026	0	<0.01	0	<0.0002

SDG Field ID		B22-Au0021810		EB2223623		EB2223623		B22-Au0021810		EB2223623		B22-Au0021810	
Sampled Date/Time		RPD		QS_04B		RPD		QS_07A		RPD		QS_07A	
				9/08/2022				9/08/2022				9/08/2022	
ChemName		Units	EQL										
2,2,2-Fluorotelomer sulfonic acid (4:2 FTS)		mg/kg	0.0005	0	<0.005	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
2,2,2-Fluorotelomer Sulfonate (6:2 FTS)		mg/kg	0.0005	0	<0.01	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
2,2,2-Fluorotelomer sulfonate (8:2 FTS)		mg/kg	0.0005	0	<0.005	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
2,2,2-Fluorotelomer sulfonic acid (10:2 FTS)		mg/kg	0.0005	0	<0.005	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
Moisture		%	0.1	3	9.1	25	5.8	6	3				
Sum of PFHxS and PFOS		mg/kg	0.0002	84	<0.005	NA	0.0013	0.0024	59				
Sum of PFAS (WA DER List)		mg/kg	0.0002	56	<0.01	NA	0.0049	0.0062	23				
Sum of PFAS		mg/kg	0.0002	56	<0.005	NA	0.0053	0.0066	22				
n-Perfluorobutanoic acid (PFBA)		mg/kg	0.001	0	<0.005	NA	<0.001	<0.001	0	<0.001	0	<0.001	<0.001
n-Perfluoropentanoic acid (PFPeA)		mg/kg	0.0002	29	<0.005	NA	0.0005	0.0005	0	0.0005	0	0.0005	0.0005
n-Perfluorohexanoic acid (PFHxA)		mg/kg	0.0002	22	<0.005	NA	0.0014	0.0015	7	0.0015	7	0.0015	0.0015
n-Perfluoroheptanoic acid (PFHpA)		mg/kg	0.0002	29	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorooctanoic acid (PFOA)		mg/kg	0.0002	29	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorononanoic acid (PFNA)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorodecanoic acid (PFDA)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluoroundecanoic acid (PFUnA)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorododecanoic acid (PFDoA)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorotridecanoic acid (PFTTrDA)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorotetradecanoic acid (PFTeDA)		mg/kg	0.0005	0	<0.005	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
n-Perfluorobutanesulfonic acid (PFBS)		mg/kg	0.0002	0	<0.005	NA	0.0017	0.0018	6	0.0018	6	0.0018	0.0018
n-Perfluoropentane sulfonic acid (PFPeS)		mg/kg	0.0002	0	<0.005	NA	0.0004	0.0004	0	0.0004	0	0.0004	0.0004
n-Perfluorohexanesulfonic acid (PFHxS)		mg/kg	0.0002	67	<0.005	NA	0.0013	0.0024	59	0.0024	59	0.0024	0.0024
n-Perfluoroheptane sulfonic acid (PFHpS)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorooctane sulfonic acid (PFOS)		mg/kg	0.0002	71	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorodecanesulfonic acid (PFDS)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
n-Perfluorooctanesulfonamide (PFOSA)		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002
Methyl perfluorooctane sulfonamide (MeFOSA)		mg/kg	0.0005	0	<0.005	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
Ethyl perfluorooctane sulfonamide (EtFOSA)		mg/kg	0.0005	0	<0.01	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
Methyl perfluorooctanesulfonamidoethanol (MeFOSE)		mg/kg	0.0005	0	<0.01	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)		mg/kg	0.0005	0	<0.005	NA	<0.0005	<0.0005	0	<0.0005	0	<0.0005	<0.0005
Ethyl perfluorooctane sulfonamidoacetic acid (Et		mg/kg	0.0002	0	<0.005	NA	<0.0002	<0.0002	0	<0.0002	0	<0.0002	<0.0002

SDG		EB2320815		EB2320815		993002	
Field ID		CM_HA12_0.1-0.2		CM_QS01A		CM_QS01B	
Sampled Date/Time		7/07/2023		7/07/2023		7/07/2023	
ChemName		Units	EQL				
	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	0.005
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	0.01
	8:2 Fluorotelomer sulfonate (8:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	0.005
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	0.005
ent	Moisture	%	0.1	19.6	18.4	6	12.0
itions	Sum of PFHxS and PFOS	mg/kg	0.0002	0.0153	0.0126	19	0.005
	Sum of PFAS (WA DER List)	mg/kg	0.0002	0.0198	0.0183	8	0.01
	Sum of PFAS	mg/kg	0.0002	0.0208	0.0185	12	0.05
	Perfluorobutanoic acid (PFBA)	mg/kg	0.001	<0.001	<0.001	0	<0.005
	Perfluoropentanoic acid (PFPeA)	mg/kg	0.0002	0.002	0.0021	5	<0.005
	Perfluorohexanoic acid (PFHxA)	mg/kg	0.0002	0.0011	0.0017	43	<0.005
	Perfluoroheptanoic acid (PFHpA)	mg/kg	0.0002	0.0007	0.0013	60	<0.005
	Perfluorooctanoic acid (PFOA)	mg/kg	0.0002	0.0005	0.0006	18	<0.005
	Perfluorononanoic acid (PFNA)	mg/kg	0.0002	0.0003	0.0002	40	<0.005
	Perfluorodecanoic acid (PFDA)	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005
	Perfluoroundecanoic acid (PFUnA)	mg/kg	0.0002	<0.0002	<0.0005	0	<0.005
	Perfluorododecanoic acid (PFDoA)	mg/kg	0.0002	0.0005	<0.0005	0	<0.005
	Perfluorotridecanoic acid (PFTrDA)	mg/kg	0.0002	<0.0002	<0.0005	0	<0.005
	Perfluorotetradecanoic acid (PFTeDA)	mg/kg	0.0005	<0.0005	<0.0012	0	<0.005
	Perfluorobutanesulfonic acid (PFBS)	mg/kg	0.0002	0.0002	<0.0002	0	<0.005
	Perfluoropentane sulfonic acid (PFPeS)	mg/kg	0.0002	<0.0002	<0.0002	0	0.005
	Perfluorohexanesulfonic acid (PFHxS)	mg/kg	0.0002	0.0015	0.0018	18	<0.005
	Perfluoroheptane sulfonic acid (PFHpS)	mg/kg	0.0002	0.0002	<0.0002	0	0.005
	Perfluorooctane sulfonic acid (PFOS)	mg/kg	0.0002	0.0138	0.0108	24	<0.005
	Perfluorodecanesulfonic acid (PFDS)	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005
	Perfluorooctanesulfonamide (PFOSA)	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.0005	<0.0005	<0.0012	0	<0.005
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005
	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSFA)	mg/kg	0.0002	<0.0002	<0.0005	0	<0.01
	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSFA)	mg/kg	0.0002	<0.0002	<0.0005	0	<0.01

SDG Field ID Sampled Date	EB2120199	EB2120199	EB2120199	812346	EB2136027
	CM - SW01	QW - 01A	RPD	QW-01B	CM_SW10
	14/07/2021	14/07/2021		14/07/2021	7/12/2021
					QSW_01A 7/12/2021

ChemName	Units	EQL							
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	0	<0.01	0	<0.007	<0.002
5:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	0.011	0.011	0	<0.05	0	<0.007	<0.002
3:3:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	<0.001	0	<0.01	0	<0.0029	<0.0008
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.008	<0.003	0	<0.01	0	<0.0029	<0.0008
Sum of PFHxS and PFOS	µg/L	0.0002	0.0251	0.0253	1	0.02	23	0.0359	0.0336
Sum of PFAS (WA DER List)	µg/L	0.0002	0.183	0.201	9	0.13	34	0.328	0.316
Sum of PFAS	µg/L	0.0002	0.187	0.205	9	0.13	36	0.331	0.32
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.02	0.0182	0	<0.05	0	0.0234	0.0218
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	0.0856	0.0802	7	0.06	35	0.0885	0.0997
Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	0.0166	0.0174	5	0.02	19	0.0593	0.0552
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	0.0369	0.0411	11	0.03	21	0.0228	0.0184
Perfluorooctanoic acid (PFOA)	µg/L	0.0005	0.0059	0.0062	5	<0.01	0	0.0137	0.0113
Perfluorononanoic acid (PFNA)	µg/L	0.0005	0.0015	0.0013	14	<0.01	0	0.0032	0.0026
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.0005	<0.0005	0	<0.01	0	<0.0029	0.0013
Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	<0.0005	<0.0005	0	<0.01	0	<0.0029	<0.0008
Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	<0.0005	<0.0005	0	<0.01	0	<0.0029	<0.0008
Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	<0.0005	<0.0005	0	<0.01	0	<0.0029	<0.0008
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	<0.0005	<0.0005	0	<0.01	0	<0.0073	<0.002
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	0.0023	0.002	14	<0.01	0	<0.0055	<0.0026
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	0.0014	0.0014	0	<0.01	0	<0.0029	<0.0018
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	0.0075	0.0075	0	<0.01	0	0.0105	0.0092
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	0.0006	0.0008	29	<0.01	0	<0.0029	<0.0009
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	0.0176	0.0178	1	0.02	13	0.0254	0.0244
Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	<0.0005	<0.0005	0	<0.01	0	<0.0029	<0.0008
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.0005	<0.0005	0	<0.05	0	<0.003	<0.001
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.001	<0.001	0	<0.05	0	0.073	0.068
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.001	<0.001	0	<0.05	0	0.011	0.008
N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.001	<0.001	0	<0.05	0	<0.003	<0.002
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.001	<0.001	0	<0.05	0	<0.0029	<0.0008
N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005	<0.0005	<0.0005	0	<0.05	0	<0.007	<0.002
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	<0.0005	<0.0005	0	<0.05	0	<0.007	<0.002

SDG			864011		EB2226315		EB2226315		B22-Se0015656	
Field ID	Field ID	Field ID	QW-01B	RPD	CM_SW16	QSW_01A	QSW_01B	RPD	QSW_01B	RPD
Sampled Date	Sampled Date	Sampled Date	10/02/2022		31/08/2022	31/08/2022	31/08/2022		31/08/2022	
ChemName	Units	EQL								
Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.005	0	<0.016	<0.015	<0.01	NA	<0.01	NA
Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.005	0	<0.016	<0.015	<0.05	NA	<0.05	NA
Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.005	0	<0.016	<0.015	<0.01	NA	<0.01	NA
2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.005	0	<0.016	<0.015	<0.01	NA	<0.01	NA
m of PFHxS and PFOS	µg/L	0.0002	0.0074	189	0.704	0.54	0.67	26	0.67	5
m of PFAS (WA DER List)	µg/L	0.0002	0.0094	192	3.63	3.35	3.23	8	3.23	12
m of PFAS	µg/L	0.0002	0.0094	192	3.63	3.35	3.31	8	3.31	9
rfluorobutanoic acid (PFBA)	µg/L	0.002	<0.005	0	0.307	0.288	0.33	6	0.33	7
rfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.001	0	1.27	1.21	1.1	5	1.1	14
rfluorohexanoic acid (PFHxA)	µg/L	0.0005	<0.001	0	0.651	0.634	0.61	3	0.61	7
rfluoroheptanoic acid (PFHpA)	µg/L	0.0005	<0.001	0	0.48	0.469	0.35	2	0.35	31
rfluorooctanoic acid (PFOA)	µg/L	0.0005	<0.001	0	0.222	0.209	0.14	6	0.14	45
rfluorononanoic acid (PFNA)	µg/L	0.0005	<0.001	0	<0.0385	<0.0355	0.04	NA	0.04	NA
rfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	<0.01	NA	<0.01	NA
rfluoroundecanoic acid (PFUnA)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	<0.01	NA	<0.01	NA
rfluorododecanoic acid (PFDoA)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	<0.01	NA	<0.01	NA
rfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	<0.01	NA	<0.01	NA
rfluorotetradecanoic acid (PFTTeDA)	µg/L	0.0005	<0.001	0	<0.04	<0.0385	<0.01	NA	<0.01	NA
rfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.001	0	<0.0325	<0.0205	0.03	NA	0.03	NA
rfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.001	0	<0.018	<0.0235	0.02	NA	0.02	NA
rfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	0.005	164	0.198	0.2	0.19	1	0.19	NA
rfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	0.02	NA	0.02	NA
rfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	0.0024	169	0.506	0.34	0.48	39	0.48	5
rfluorodecanesulfonic acid (PFDS)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	<0.01	NA	<0.01	NA
rfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.001	0	<0.016	<0.0154	<0.05	NA	<0.05	NA
Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.005	0	<0.04	<0.038	<0.05	NA	<0.05	NA
Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.001	0	<0.04	<0.038	<0.05	NA	<0.05	NA
Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.001	0	<0.04	<0.038	<0.05	NA	<0.05	NA
Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.005	0	<0.04	<0.038	<0.05	NA	<0.05	NA
Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005	<0.005	0	<0.016	<0.0154	<0.05	NA	<0.05	NA
Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	<0.005	0	<0.016	<0.0154	<0.05	NA	<0.05	NA

triplicates (WATER)

SDG		RPD	B22-Se0015657		RPD	EB2309891		R
Field ID	Sampled Date		QGW_01B	31/08/2022		CM_MB10	CM_QW02A	
						27/03/2023	27/03/2023	

Group	ChemName	Units	EQL					
	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	NA	NA	<0.002	<0.002	<0.002
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	15	2	0.205	0.212	0.212
	8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	NA	NA	0.008	0.007	0.007
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	NA	NA	<0.002	<0.002	<0.002
Summations	Sum of PFHxS and PFOS	µg/L	0.0002	16	2	0.245	0.256	0.256
	Sum of PFAS (WA DER List)	µg/L	0.0002	3	17	1.89	2.08	2.08
	Sum of PFAS	µg/L	0.0002	4	8	1.92	2.11	2.11
	Perfluorobutanoic acid (PFBA)	µg/L	0.002	7	28	0.154	0.16	0.16
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	14	8	0.732	0.802	0.802
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	4	7	0.318	0.335	0.335
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	4	55	0.15	0.158	0.158
	Perfluorooctanoic acid (PFOA)	µg/L	0.0005	7	27	0.0471	0.0428	0.0428
	Perfluorononanoic acid (PFNA)	µg/L	0.0005	NA	NA	0.0085	0.008	0.008
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	NA	NA	<0.004	<0.004	<0.004
	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	9	122	0.0326	0.107	0.107
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	5	47	0.0141	0.0129	0.0129
	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	2	14	0.0703	0.0679	0.0679
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	12	8	0.0075	0.0066	0.0066
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	21	1	0.175	0.188	0.188
	Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	NA	NA	-	-	-
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	NA	NA	<0.004	<0.004	<0.004
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	NA	NA	<0.004	<0.004	<0.004
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	NA	NA	<0.004	<0.004	<0.004
	N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016
	N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	NA	NA	<0.0016	<0.0016	<0.0016

SDG		979318	EB2309891		979318	EB2309891		979318
Field ID	CM_QW02B	RPD	BW05_2	BW_QW01A	RPD	BW_QW01B	RPD	RPD
Sampled Date	27/03/2023		29/03/2023	29/03/2023		29/03/2023		

ChemName	Units	EQL						
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	< 0.01			<0.002	<0.002	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	0.15		133	<0.002	<0.002	0
8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	< 0.01		22	<0.002	<0.002	0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.01		0	<0.002	<0.002	0
Sum of PFHxS and PFOS	µg/L	0.0002	0.19		25	0.158	0.149	6
Sum of PFAS (WA DER List)	µg/L	0.0002	1.39		30	0.326	0.318	2
Sum of PFAS	µg/L	0.0002	1.4		31	0.348	0.337	3
Perfluorobutanoic acid (PFBA)	µg/L	0.002	0.11		33	0.0146	0.0165	12
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	0.66		10	0.0535	0.054	1
Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	0.15		72	0.05	0.051	2
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	0.09		50	0.0275	0.027	2
Perfluorooctanoic acid (PFOA)	µg/L	0.0005	0.04		16	0.0114	0.0114	0
Perfluorononanoic acid (PFNA)	µg/L	0.0005	<0.01		0	0.0056	0.0051	9
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.01		0	<0.0016	<0.0016	0
Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	<0.01		0	<0.0016	<0.0016	0
Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	<0.01		0	<0.0016	<0.0016	0
Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	<0.01		0	<0.0016	<0.0016	0
Perfluorotetradecanoic acid (PFTTeDA)	µg/L	0.0005	<0.01		0	<0.004	<0.004	0
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.01		106	0.0184	0.0181	2
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.01		34	0.0137	0.0117	16
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	0.08		13	0.0648	0.0609	6
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	0.01		29	0.0027	0.0022	20
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	0.11		46	0.0931	0.0878	6
Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	<0.01		0	<0.0016	<0.0016	0
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.05		0	<0.0016	<0.0016	0
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.05			<0.005	<0.005	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.05		170	<0.004	<0.004	0
N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.05		0	<0.004	<0.004	0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.05		0	<0.004	<0.004	0
N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005	<0.05		0	<0.0016	<0.0016	0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	<0.05		0	<0.0016	<0.0016	0

SDG	EB2309891	979318	EB2320815	EB2320815
Field ID	CM_QW01A	CM_QW01B	CM_OVERPASS_DAM	CM_QW_01A
Sampled Date	27/03/2023	27/03/2023	7/07/2023	7/07/2023

ChemName	Units	EQL				
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	0	<0.01	<0.001
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.001	0	<0.05	<0.001
8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	0	<0.01	<0.001
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.001	0	<0.01	<0.001
Sum of PFHxS and PFOS	µg/L	0.0002	0.0031	38	<0.01	<0.0002
Sum of PFAS (WA DER List)	µg/L	0.0002	0.0399	9	<0.05	<0.0015
Sum of PFAS	µg/L	0.0002	0.0399	9	<0.1	<0.0015
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.0044	0	<0.05	<0.0077
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	0.0119	60	0.01	0.0007
Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	0.007	0	<0.01	<0.0005
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	0.0022	51	<0.01	<0.0005
Perfluorooctanoic acid (PFOA)	µg/L	0.0005	0.0008	0	<0.01	<0.0005
Perfluorononanoic acid (PFNA)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorotetradecanoic acid (PFTTeDA)	µg/L	0.0005	<0.0005	0	<0.01	<0.0039
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	0.0145	160	<0.01	<0.0005
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	0.0009	0	<0.01	<0.0005
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	0.0022	5	<0.01	<0.0002
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0005	<0.0005	0	<0.01	<0.0005
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.0005	0	<0.05	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.005	0	<0.05	<0.004
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.002	0	<0.05	<0.004
N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.002	0	<0.05	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.001	0	<0.05	<0.001
N-Ethyl perfluorooctane sulfonamidoacetic acid (Et	µg/L	0.0005	<0.0005	0	<0.05	<0.0015
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.0005	<0.0005	0	<0.05	<0.0005

SDG			EB2123606		EB2123606		819212		EB2203901		EB2203901	
Field ID			MB10		QW-03A		QW-03B		DC02		QW-01A	
Sampled Date			17/08/2021		17/08/2021		17/08/2021		10/02/2022		10/02/2022	
ChemName			Units	EQL								
Perfluorobutanoic acid (PFBA)	Perfluorobutanoic acid (PFBA)	µg/L	0.01 (Primary): 0.005 (Interlab)	0.17	0.17	0	0.13	27	<0.01	<0.01	0	
	Perfluoropentanoic acid (PFPeA)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.671	0.676	1	0.58	15	0.002	<0.002	0	
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.138	0.138	0	0.11	23	<0.002	<0.002	0	
	Perfluorohexanoic acid (PFHxA)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.461	0.447	3	0.27	52	<0.002	<0.002	0	
	Perfluorooctanoic acid (PFOA)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.036	0.038	5	0.029	22	<0.002	<0.002	0	
	Perfluorononanoic acid (PFNA)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.006	0.007	15	0.007	15	<0.002	<0.002	0	
	Perfluorodecanoic acid (PFDA)	µg/L	0.002 (Primary): 0.001 (Interlab)	<0.002	<0.002	0	<0.001	0	<0.002	<0.002	0	
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.002 (Primary): 0.001 (Interlab)	<0.002	<0.002	0	<0.001	0	<0.002	<0.002	0	
	Perfluorododecanoic acid (PFDoA)	µg/L	0.002 (Primary): 0.001 (Interlab)	<0.002	<0.002	0	<0.001	0	<0.002	<0.002	0	
	Perfluorotridecanoic acid (PFTriDA)	µg/L	0.002 (Primary): 0.001 (Interlab)	<0.002	<0.002	0	<0.001	0	<0.002	<0.002	0	
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.005 (Primary): 0.001 (Interlab)	<0.005	<0.005	0	<0.001	0	<0.005	<0.005	0	
	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.012	0.014	15	0.009	29	<0.002	<0.002	0	
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.01	0.012	18	0.006	50	<0.002	<0.002	0	
	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.055	0.05	10	0.051	8	<0.002	<0.002	0	
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.002 (Primary): 0.001 (Interlab)	0.005	0.006	18	0.008	46	<0.002	<0.002	0	
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.002 (Primary): 0.0001 (Interlab)	0.148	0.155	5	0.16	8	<0.002	<0.002	0	
	Perfluorodecanesulfonic acid (PFDS)	µg/L	0.002 (Primary): 0.001 (Interlab)	<0.002	<0.002	0	<0.001	0	<0.002	<0.002	0	
	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.002 (Primary): 0.005 (Interlab)	<0.002	<0.002	0	<0.005	0	0	<0.002	<0.002	0
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.005	<0.005	<0.005	0	<0.005	0	0	<0.005	<0.005	0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.005	<0.005	<0.005	0	<0.005	0	0	<0.005	<0.005	0	
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	µg/L	0.005	<0.005	<0.005	0	<0.005	0	0	<0.005	<0.005	0	
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.005	<0.005	<0.005	0	<0.005	0	0	<0.005	<0.005	0	
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.002 (Primary): 0.005 (Interlab)	<0.002	<0.002	0	<0.005	0	0	<0.002	<0.002	0	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.002 (Primary): 0.005 (Interlab)	<0.002	<0.002	0	<0.005	0	0	<0.002	<0.002	0	
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.005 (Primary): 0.001 (Interlab)	<0.005	<0.005	0	<0.001	0	0	<0.005	<0.005	0	
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.005	<0.005	<0.005	0	0.14	186	0	<0.005	<0.005	0	
8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.005 (Primary): 0.001 (Interlab)	<0.005	<0.005	0	0.006	18	0	<0.005	<0.005	0	
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.005 (Primary): 0.001 (Interlab)	<0.005	<0.005	0	<0.001	0	0	<0.005	<0.005	0	
Sum of PFHxS and PFOS	µg/L	0.002 (Primary): 0.001 (Interlab)	0.203	0.205	1	0.211	4	4	<0.002	<0.002	0	
Sum of PFAS	µg/L	0.002 (Primary): 0.005 (Interlab)	1.71	1.71	0	1.51	12	12	0.002	<0.002	0	
Sum of TOP C4 - C14 as Fluorine	µg/L	0.002	1.12	1.12	0	-	-	-	<0.002	<0.002	0	
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfo	µg/L	0.002	1.71	1.71	0	-	-	-	0.002	<0.002	0	

SDG	EB2136027	EB2136027	EB2136027	849498	EB2222999-AB	EB2223623
Field ID	TG_SED02	QSED_01_A	QSED_01_B	QSED_01_B	CM_SED08	QSED_01A
Sampled Date/Time	7/12/2021	7/12/2021	7/12/2021	7/12/2021	2/08/2022	2/08/2022
	RPD	RPD	RPD	RPD		RPD

Name	Units	EQL				
uorotelomer sulfonic acid (4:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
uorotelomer Sulfonate (6:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
uorotelomer sulfonate (8:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
luorotelomer sulfonic acid (10:2 FTS)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
ure	%	0.1	7.8	5.8	29	NA
of PFHxS and PFOs	mg/kg	0.0002	0.0024	0.0026	8	NA
of PFAS (WA DER List)	mg/kg	0.0002	0.0027	0.003	11	NA
of PFAS	mg/kg	0.0002	0.0027	0.003	11	NA
orobutanoic acid (PFBA)	mg/kg	0.001	<0.001	<0.001	0	NA
oropentanoic acid (PFPeA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orohexanoic acid (PFHxA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orohheptanoic acid (PFHpA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orooctanoic acid (PFOA)	mg/kg	0.0002	0.0003	0.0004	29	NA
orononanoic acid (PFNA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orodecanoic acid (PFDA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
oroundecanoic acid (PFUnA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orododecanoic acid (PFDoA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orotridecanoic acid (PFTriDA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orotetradecanoic acid (PFTeDA)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
orobutanesulfonic acid (PFBS)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
oropentane sulfonic acid (PFPeS)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orohexanesulfonic acid (PFHxS)	mg/kg	0.0002	0.0006	0.0007	15	NA
oroheptane sulfonic acid (PFHpS)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orooctane sulfonic acid (PFOs)	mg/kg	0.0002	0.0018	0.0019	5	NA
orodecanesulfonic acid (PFDS)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
orooctanesulfonamide (PFOSA)	mg/kg	0.0002	<0.0002	<0.0002	0	NA
thyl perfluorooctane sulfonamide (MeFOSA)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
yl perfluorooctane sulfonamide (EtFOSA)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
thyl perfluorooctanesulfonamidoethanol (MeFOSE)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
yl perfluorooctane sulfonamidoethanol (EtFOSE)	mg/kg	0.0005	<0.0005	<0.0005	0	NA
yl perfluorooctane sulfonamidoacetic acid (Et	mg/kg	0.0002	<0.0002	<0.0002	0	NA
thyl perfluorooctane sulfonamidoacetic acid	mg/kg	0.0002	<0.0002	<0.0002	0	NA

1. The EQL is the maximum acceptable concentration in the sample. The EQL is derived where a concentration is greater than 1 times the EQL.
 2. The RPD is the relative percent difference. The RPD is calculated for each EQL multiplier range are: 50 (1-10 x EQL); 30 (10-30 x EQL); 30 (> 30 x EQL))
 3. Any methods in the row header relate to those used in the primary laboratory attached on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

4:2 Fluorotelomer sulfonic acid (4:2 FTS)	SDG	EB2136027	EB2136027	EB2203901	EB2222999-AB	EB2223623	EB22
	Field ID	RINSE_1	RINSE_2	Trip Blank 1	W_RB05	W_RB06	W_
	Sampled_Date	7/12/2021	8/12/2021	10/02/2022	3/08/2022	5/08/2022	6/08
	Sample Type	Rinsate	Rinsate	Rinsate	Rinsate	Rinsate	Rin

ChemName	Units	EQL					
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.001	<0.001	0.002	<0.001	<0
8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0
Sum of PFHxS and PFOS	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.
Sum of PFAS (WA DER List)	µg/L	0.0002	<0.0002	<0.0002	0.002	<0.0002	<0.
Sum of PFAS	µg/L	0.0002	--	--	0.002	<0.0002	<0.
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.
Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.
Perfluorooctanoic acid (PFOA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.
Perfluorononanoic acid (PFNA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	--	--	<0.0005	<0.0005	<0.
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	--	--	<0.001	<0.001	<0
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	--	--	<0.001	<0.001	<0
N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	--	--	<0.001	<0.001	<0
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	--	--	<0.001	<0.001	<0

ER)

SDG	EB2226315	EB2226315	EB2226315	EB2222999-AB	EB2223623	EB2223623	EB2223623	EB2226315	EB2226315
Field ID	W_RB25	W_RB26	W_TB03	W_TB04	W_TB06	W_TB08	W_TB	W_TB	W_TB
Sampled_Date	31/08/2022	31/08/2022	3/08/2022	6/08/2022	8/08/2022	31/08/2022	31/08/2022	31/08/2022	31/08/2022
Sample Type	Rinsate	Rinsate	Trip_B	Trip_B	Trip_B	Trip_B	Trip_B	Trip_B	Trip

ChemName	Units	EQL							
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0
8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0
Sum of PFHxS and PFOS	µg/L	0.0002	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0
Sum of PFAS (WA DER List)	µg/L	0.0002	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0
Sum of PFAS	µg/L	0.0002	<0.0003	<0.0003	-	-	-	-	-
Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.0
Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0
Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0
Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0
Perfluorooctanoic acid (PFOA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0
Perfluorononanoic acid (PFNA)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorotetradecanoic acid (PFTTeDA)	µg/L	0.0005	<0.0008	<0.0008	-	-	-	-	-
Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.0005	<0.0005	-	-	-	-	-
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.001	<0.001	-	-	-	-	-
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.001	<0.001	-	-	-	-	-
N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.001	<0.001	-	-	-	-	-
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.001	<0.001	-	-	-	-	-

SDG	EB2226315	EB2226315	EB2226315	EB2226315	EB2226315	EB2226315	EB2309891	EB2309891	EB2309891	E
Field ID	W_TB11	W_TB05	W_TB16	W_TB17	CM_RB01	CM_RB02	CM_RB03	CM_RB03	CM_RB03	C
Sampled_Date	31/08/2022	31/08/2022	31/08/2022	31/08/2022	24/03/2023	27/03/2023	27/03/2023	27/03/2023	27/03/2023	27
Sample Type	Trip_B	Trip_B	Trip_B	Trip_B	Trip_B	Trip_B	Rinsate	Rinsate	Rinsate	
ChemName	Units	EQL								
2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
0:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
um of PFHxS and PFOS	µg/L	<0.0002	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	
um of PFAS (WA DER List)	µg/L	<0.0002	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	
um of PFAS	µg/L	-	-	-	-	<0.0002	<0.0002	<0.0002	<0.0002	
erfluorobutanoic acid (PFBA)	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	
erfluoropentanoic acid (PFPeA)	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorohexanoic acid (PFHxA)	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
erfluoroheptanoic acid (PFHpA)	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorooctanoic acid (PFOA)	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorononanoic acid (PFNA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorodecanoic acid (PFDA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluoroundecanoic acid (PFUnA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorododecanoic acid (PFDoA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorotridecanoic acid (PFTTrDA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorotetradecanoic acid (PFTeDA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorobutanesulfonic acid (PFBS)	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
erfluoropentane sulfonic acid (PFPeS)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorohexanesulfonic acid (PFHxS)	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
erfluoroheptane sulfonic acid (PFHpS)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorooctane sulfonic acid (PFOS)	µg/L	<0.0002	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	
erfluorodecanesulfonic acid (PFDS)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
erfluorooctanesulfonamide (PFOSA)	µg/L	-	-	-	-	<0.0005	<0.0005	<0.0005	<0.0005	
-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	-	-	-	-	<0.001	<0.001	<0.001	<0.001	
-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	-	-	-	-	<0.001	<0.001	<0.001	<0.001	
-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	-	-	-	-	<0.001	<0.001	<0.001	<0.001	
-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	-	-	-	-	<0.001	<0.001	<0.001	<0.001	

Field Blanks (WATER)											
Chem_Group	ChemName	Units	EQL	EB2309891 CM_RB06 29/03/2023 Rinsate	EB2309891 CM_TB01 24/03/2023 Rinsate	EB2309891 CM_TB02 27/03/2023 Rinsate	EB2309891 CM_TB03 29/03/2023 Rinsate	EB2309891 CM_TB04 29/03/2023 Rinsate	EB2320891 QW_RB03 7/07/2023 Rinsate		
SDG Field ID Sampled_Date Sample Type											
FA											
	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	8:2 Fluorotelomer sulfonate (8:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
PFAS Summations											
	Sum of PFHxS and PFOS	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
	Sum of PFAS (WA DER List)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
	Sum of PFAS	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
CA											
	Perfluorobutanoic acid (PFBA)	µg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002		
	Perfluoropentanoic acid (PFPeA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorohexanoic acid (PFHxA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorooctanoic acid (PFOA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorononanoic acid (PFNA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorodecanoic acid (PFDA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluoroundecanoic acid (PFUnA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorododecanoic acid (PFDoA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorotridecanoic acid (PFTTrDA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorotetradecanoic acid (PFTTeDA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	FA	Perfluorobutanesulfonic acid (PFBS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorohexanesulfonic acid (PFHxS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002		
	Perfluorodecane sulfonic acid (PFDS)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
SS	Perfluorooctanesulfonamide (PFOSA)	µg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005		
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	N-Methyl perfluorooctanesulfonamidoethanol (MeFOSE)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		



APPENDIX D ENVIRONMENTAL EVALUATION NOTICE

Notice

Environmental Protection Act 1994

Environmental Evaluation

Amended Notice to conduct or commission an environmental evaluation

This notice to conduct or commission an environmental evaluation is issued by the administering authority pursuant to section 326B of the Environmental Protection Act 1994.

Batchfire Callide Pty Ltd and Batchfire Callide No. 2 Pty Ltd
Sect 2, Level 11
141 Queen Street
BRISBANE CITY QLD 4000

Our reference: STAT-E-100078550

Monday, 16 October 2023

Take notice: that under the *Environmental Protection Act 1994* (the Act) a notice to conduct or commission an environmental investigation is issued to Batchfire Callide Pty Ltd and Batchfire Callide No. 2 Pty Ltd (Batchfire) by the administering authority. The administering authority is the Chief Executive of the Department of Environment and Science (the department).

The notice to conduct or commission an environmental investigation is issued in respect of the activities of Batchfire at Callide Coal Mine on land described as Mining Lease (ML) 80118, ML80093, ML80122, ML80107, ML80151, ML80115, ML80186, ML80117, ML5632, ML5641, ML5653, ML5654, ML5655, ML6993, ML6994, ML80030, ML700059 and ML80092 (Callide Coal Mine). Callide Coal Mine consists of four mining areas: Dunn Creek, The Hut, Trap Gully and Boundary Hill.

This notice was issued on **16 December 2021** and amended on **25 May 2022** and **24 July 2023**.
New text in this amended notice is shown as underlined and deleted text is shown as strikethrough.

A. Grounds

The notice to conduct or commission an environmental investigation is issued on the following grounds:

1. Under section 326BA of the Act, the department is satisfied on reasonable grounds that:
 - a) particulars of the land are recorded in the environmental management register or contaminated land register;
 - b) a hazardous contaminant is contaminating the land, and is in a concentration that has the potential to cause serious environmental harm or material environmental harm; and
 - c) a person, animal or another part of the environment may be exposed to the hazardous contaminant, whether on the land or not.

The facts and circumstances forming the basis for these grounds are:

Notice to conduct or commission an environmental evaluation

1. Batchfire holds Environmental Authority (EA) EPML00720413 for operations at Callide Coal Mine, authorising environmentally relevant activities; mining black coal, crushing, milling, grinding or screening and sewage treatment 1.
2. The Environmental Management Register lists Lot 100 on Plan SP301602, formerly Lot 50 on Plan RP843057, (Dunn Creek Mining Area) for engine reconditioning works and petroleum product or oil storage.
3. Following the release of the Queensland Department of Environment and Science (DES) Operational Policy for the Environmental Management of Firefighting Foam in 2016, Batchfire undertook a review of site operations and identified historical use of PFAS containing Aqueous Film-Forming Foams (AFFF) at Callide Coal Mine. Dunn Creek Mining Area was identified as the location of concern, due to the historical PFAS use at a former fire training area (FFTA) and a warehouse/workshop area (WWA).
4. PFOS, PFHxS and PFOA are the different chemicals which are collectively known as PFAS.
5. Batchfire identified that between 2009 and 2015, approximately 7,122 litres of PFAS containing AFFF was used at Callide Coal Mine.
6. Based on limited sampling at historical use of PFAS areas, in 2019 Batchfire removed 613.08 tonnes of PFAS contaminated soil from the FFTA.
7. In April 2021, Batchfire conducted further onsite sampling, identifying that PFAS contamination remained at Callide Coal Mine.
8. On 26 August 2021, Batchfire notified the department of preliminary PFAS sampling results for the Dunn Creek Mining Area, indicating varying levels of PFAS contamination in soil and sediment and surface water samples.
9. On 13 September 2021, Batchfire provided a report titled *Callide Mine Site Per-and Poly-Fluoroalkyl Substances Preliminary Site Investigation* (report) to the department. This report was limited to PFAS investigations at the Dunn Creek Mining Area. The report identified surface water and groundwater sample results with concentrations of PFOS exceeding PFAS NEMP freshwater values and PFAS NEMP drinking water values:
 - a) Surface water sample taken at WWA on 14 July 2021 identified PFHxS levels of 0.469ug/L, PFOS levels of 0.992ug/L, with the sum of PFOS + PFHxS as 1.46ug/L;
 - b) Groundwater sample taken north of the WWA on 17 August 2021 identified PFHxS levels of 0.604ug/L, PFOS levels of 0.883ug/L, with the sum of PFOS + PFHxS as 1.49ug/L.
10. Dunn Creek Dam (within the Dunn Creek Mining Area), located approximately 880m south-east downgradient to FTA (PFAS historical use area), is a valley-fill catch dam situated in the main channel of Dunn Creek and passively overflows to Callide Creek. Sample results submitted on 13 September 2021 for Dunn Creek Dam identified PFOS concentrations of 0.0176ug/L. However, the sample was dominated by PFCAs (75%), which may indicate significant biotransformation has occurred from the original source (FFTA).
11. PFAS contamination has been detected in a drainage channel, downstream and offsite to Callide Coal Mine's warehouse/workshop area through samples taken as part of a regional investigation into PFAS, including a sample taken on 7 July 2021 with PFOS + PFHxS concentration of 0.359ug/L and Total PFAS 6.6200ug/L.

Notice to conduct or commission an environmental evaluation

12. Potential pathways for contamination to migrate offsite, identified in the report provided on 13 September 2021 include:
 - a) Leaching of PFAS from impacted soils into groundwater;
 - b) Suspension/transportation of PFAS impacted soil to surface waters and drainage channels during rainfall events and runoff from impacted surfaces (e.g. exposed PFAS soil in the former FTA area or WWA);
 - c) Migration of PFAS impacted water downgradient between surface water bodies via drainage channels; and
 - d) Groundwater migration downgradient, potentially discharging into surface water bodies such as Dunn Creek Dam or Callide Dam.
13. On 13 September 2021, Batchfire provided the department with preliminary PFAS sampling results for the Boundary Hill Mining Area. Results indicating varying levels of PFAS contamination in soil and surface water.
14. PFAS compounds, including PFOS, are prescribed water contaminants under Schedule 10 of the Environmental Protection Regulation 2019.
15. Environmental harm is defined by section 14 of the Act as any adverse effect, or potential adverse effect on an environmental value.
16. An environmental value, defined in section 9 of the Act, is a quality or physical characteristic of the environment that is conducive to ecological health or public amenity or safety.
17. Under the Environmental Protection (Water) Policy 2009 (Water EPP), all Queensland waters, including groundwater and surface waters, have prescribed environmental values and water quality objectives. Environmental values and water quality objectives for these waters are listed in Schedule 1 of the Water EPP.
18. Callide Coal Mine is located within the Callide Creek catchment of the Callide Basin in the upper Fitzroy Basin. The groundwater and surface environmental values which apply to the Callide Creek Catchment include drinking water, irrigation, farm water supply, aquatic ecosystem protection, stock water, primary recreation, industrial use, and cultural and spiritual values.
19. Callide Creek is a regionally significant watercourse located approximately 4km south and 9km west of the mine and is used by landholders for drinking, domestic, irrigation, farm water supply and stock watering. Callide Creek flows into Callide Dam. Callide Dam is used for recreational, agricultural, and drinking water purposes.
20. Ecological health is an additional environmental value prescribed by the Act that may be adversely affected by the release of PFAS into the environment, through bioaccumulation in aquatic and terrestrial organisms. PFAS contamination can be environmentally significant due to its persistence, mobility and, for some PFAS, toxicity and potential bioaccumulation in plants and animals (HEPA 2020).
21. Based on the facts and circumstances above, the department is satisfied that the PFAS contamination to land and waters at Callide Coal Mine has the potential to cause environmental harm through migration offsite and contribute to PFAS contamination of waters that are used for drinking water and agriculture purposes.

Notice to conduct or commission an environmental evaluation

22. On 10 October 2023, Batchfire representatives submitted a request to the department for extension of timeframes of Requirements 7 and 10, to provide further time to produce the required reports.

B. Requirements

The report on the environmental investigation must address the following relevant matters:

- 1) By **5:00pm on 31 December 2021**, Batchfire must engage an independent suitably qualified person/s (**SQP**) under the *Environmental Protection Act 1994* (the Act) to carry out the requirements of this notice. The SQP must demonstrate skills and experience in technical fields such as soil and groundwater contamination assessment and with particular skills relevant to AFFF firefighting foams containing PFAS.
- 2) By **5:00pm on 25 February 2022**, Batchfire must engage an approved contaminated land auditor to undertake an auditor's function as outlined in Section 568(b) of the Act, to oversee the SQP carrying out the requirements of this notice.
- 3) In the event that monitoring of the affected environment identifies a risk of public exposure to PFAS at concentrations greater than the relevant human health guideline value, Batchfire must notify the department of the results and findings within 24 hours of becoming aware of the risk.
- 4) By **5:00pm on 29 April 2022**, Batchfire must develop and submit a preliminary site investigation (**PSI**) report prepared in accordance with the *National Environmental Protection (Assessment of Site Contamination) Measure 1999* (ASC NEPM). Notwithstanding ASC NEPM, the report must include:
 - a) Identification of current and historical activities undertaken at the premises which has involved the use, storage (including volume), handling, foam types and potential release of PFAS containing material;
 - b) Identification of all PFAS contaminant source zones and potential pathways into the environment;
 - c) Identification of the relevant environmental values, including an evaluation of the uses of land and waters, and any potential impact and risks to the users as a result of potential PFAS contamination;
 - d) Identification of the Data Quality Objectives (DQOs) as defined in Schedule B2 of the ASC NEPM;
 - e) A summary of the monitoring results completed prior to 29 April 2022; and
 - f) Preliminary Conceptual Site Model (CSM).
- 5) By **5:00pm on 10 June 2022**, Batchfire must develop and submit a Work Plan outlining the overall investigation strategy for the Detailed Site Investigation, inclusive of a sampling, analysis and quality plan (**SAQP**).
 - a) The SAQP may include a staged approach, such as Sampling Phase 1 to characterise the source, cause and extent of PFAS contamination at the premises for the purpose of preparing a site investigation report as defined in section 387 of the Act. Followed by Sampling Phase 2 if required for supplementary sampling based on remaining information gaps.
 - b) This SAQP must be prepared by a SQP and consented to by a contaminated land auditor.

Comments provided to Batchfire by the department by **5:00pm on 1 July 2022** (if any) must be incorporated in the sampling, analysis and quality plan prior to implementing the plan.
- 6) By **5:00pm on 26 July 2022**, Batchfire must commence sampling and analysis in accordance with the SAQP required by Requirement 5 to determine the nature and extent of impact arising from any direct or indirect release of PFAS and any other contaminants of potential concern identified in the PSI in relation to the premises.

Notice to conduct or commission an environmental evaluation

This investigation must, as a minimum:

- a) evaluate the nature and extent of contamination likely to have been caused by any direct or indirect release from the premises to soil quality, water quality, groundwater and sediments., Biota sampling must be included as part of the investigation if there are shown to be potentially complete Source Pathway Receptor linkages as per the CSM;
- b) identify pathways including, but not limited to, the premises, surface waters, drainage lines, stormwater infrastructure and groundwater in the vicinity of the premises;
- c) assess the nature of the connectivity/completeness of those pathways by assessing groundwater levels versus surface water levels and connectivity, hydraulic conductivity and groundwater velocity, and evaluate the potential for contaminant migration offsite and into Callide Dam during heavy rainfall events
- d) the sampling analysis must include all requirements stated in Requirement 9.

7) By **5:00pm on 16 October 2023** **31 May 2024**, Batchfire must submit a contaminated land investigation document (CLID) that is a **detailed site investigation** (DSI) report detailing the findings of the sampling, analysis and quality plan to determine the nature and extent of impact arising from any direct or indirect release of any ~~hazardous contaminants~~ PFAS contaminants from the release of AFFF.

8) The investigations required by this notice must meet the requirements for a CLID for the land in accordance with section 389 and 390 of the Act. A CLID must be prepared by a SQP as required by and in accordance with Chapter 12, Part 3 of the Act and be accompanied by an auditor certification that the CLID complies with section 389(1) and (2) of the Act.

Note: Where existing investigations have been completed, and are relevant to addressing the requirements of this notice, you may use these investigations to address relevant parts of this notice, pending agreement by the SQP and the auditor.

9) Batchfire must ensure that the following requirements, to the extent that they are applicable and specified requirements are not otherwise referred to, are met when conducting the investigation and preparing the report:

- a. The investigation is conducted in accordance with the following:
 - i. the Act – see <https://www.legislation.qld.gov.au/view/pdf/inforce/current/act-1994-062>;
 - ii. The Policy – see <https://www.legislation.qld.gov.au/view/pdf/inforce/current/si-2019-0156>;
 - iii. Queensland Water Quality Guidelines (2009) – see <https://environment.des.qld.gov.au/management/water/quality-guidelines>;
 - iv. Monitoring and Sampling Manual 2009 Environmental Protection (Water) Policy 2009 Version 2 September 2010 see - <http://www.ehp.qld.gov.au/water/pdf/monitoring-man-2009-v2.pdf>;
 - v. National Environmental Protection (Assessment of Site Contamination) Measure 1999 – see <http://nepc.gov.au/nepms/assessment-site-contamination>;
 - vi. Guidelines for Contaminated Land Professionals – see <https://www.qld.gov.au/environment/pollution/management/contaminated-land>;
 - vii. Assessment of impact of human health considering the Tolerable Daily Intakes for PFOS, PFOA, and PFHxS recommended by Food Standards Australia New Zealand (FSANZ);

Notice to conduct or commission an environmental evaluation

- viii. Where PFAS are encountered in water bodies at the premise which are accessible to fauna such as birds and mammals, qualitative consideration of water to animal bioaccumulation factors reported in research publications concerning those contaminants in evaluating potential environmental harm to such animals; and
- ix. Assessment of contamination considering guidance provided in the PFAS NEMP – see <https://www.qld.gov.au/environment/pollution/management/disasters/investigation-pfas/management-plan>.
- b. An assessment of edible portions (biota) must be used in estimating risks of exceeding the tolerable daily intakes, being consistent with the Queensland Health Guideline for sampling and analysis of seafood suitable for human health risk assessments of PFAS contamination (see https://www.qld.gov.au/data/assets/pdf_file/0032/68684/pfas-fish-sampling-protocol.pdf) and adopting portion sizes recommended by Food Standards Australia New Zealand (FSANZ) in addition to assessment of whole species (biota) to evaluate bioaccumulation risk; and
- c. Wherever practical, all samples must be analysed by a NATA accredited laboratory (it is noted that in biota sampling this may not be applicable); and
- d. The analytical data on all media (soil, sediment, water, groundwater and biota) must include results for sampling to determine total organic fluorine, total oxidisable precursor (TOP) assay, and the suite of 20 to 28 standard fluorinated organic compounds by liquid chromatography-mass spectrometry (LC/MS/MS) available from commercial laboratories reported as the analyses for the resulting perfluorinated carboxylates for C4 to C14 carbon chain length (TOP C4-C14); and
- e. Note that as analytical and instrumental improvements are made regarding the analysis for PFAS it is understood that some laboratories are increasing the standard suite which may assist you in distinguishing between the premises sources of PFAS and other potential sources; and
- f. Where TOP Assay is performed, quality assurance checks must include that oxidant exhaustion has not occurred (e.g. reanalysis to determine presence of fluorotelomer); and
- g. Groundwater bores are constructed in accordance with the Minimum Construction Requirements for Water Bores in Australia (3rd edition); and
- h. Where comparisons are to be made of PFAS sediment concentrations between locations, incorporate determination on the < 63 micron size fraction and organic carbon content to allow standardisation.

10) By 5:00pm on 15 December 2023 30 June 2024, Batchfire must submit a **final environmental report** to the administering authority that demonstrates that the requirements of this environmental evaluation have been completed.

The environmental investigation must be carried out, and the environmental report prepared by a suitably qualified person. A suitably qualified person is defined as 'a person who has professional qualifications, training, skills or experience relevant to the Environmental Evaluation requirements, and can give authoritative assessment, advice and analysis in relation to the Environmental Evaluation using relative relevant protocols, standards, methods or literature'.

As the recipient of this notice, Batchfire are also required to provide a statutory declaration in the form attached, to accompany the environmental report submitted to the department.

The suitably qualified person who prepares the environmental report must also provide a statutory declaration in the form attached to the environmental report submitted to the department.

Notice to conduct or commission an environmental evaluation

Copies of the template statutory declarations can also be accessed from the Queensland Government website at www.qld.gov.au, using the publication number as a search term:

1. Statutory declaration environmental evaluation for recipient ([ESR/2016/1997](#))
2. Statutory declaration for suitably qualified person ([ESR/2016/2266](#))

Take notice:

1. The requirements of the notice to conduct or commission an environmental investigation take effect immediately upon service of this notice;
2. This notice remains in force until further notice from the department; and
3. Batchfire are responsible for meeting the costs of conducting or commissioning the environmental evaluation, preparing the environmental report and providing any further information as requested by the department.

C. Reviews and appeals

The provisions regarding reviews of decisions and appeals are found in sections 519 to 539 of the Act.

A person who is dissatisfied with certain decisions of the department, may be able to apply to have the department review that original decision.

Generally, a request to have a decision reviewed must:

- be made within 10 business days of the decision being notified to the person;
- be supported by enough information to enable the department to decide the application for review; and
- be made using the application form, Application for review of original decision ([ESR/2015/1573](#)) available on the Queensland Government website at www.qld.gov.au, using the publication number (ESR/2015/1573) as a search term.

Where an application has been made for a decision to be reviewed, the applicant may also apply to the relevant court for a stay of the decision to secure the effectiveness of the review.

Once the original decision has been reviewed, a person who is dissatisfied with the review decision may be able to appeal against that decision to the relevant court within 22 business days after receiving notice of the review decision.

A person whose interests are or would be adversely affected by a decision of the department may also be able to request a statement of reasons for a decision or a statutory order review under the *Judicial Review Act 1991*.

For further information about reviews and appeals see the information sheet, Internal review and appeals ([ESR/2015/1742](#)) available on the Queensland Government website at www.qld.gov.au, using the publication number (ESR/2015/1742) as a search term.

The information sheets are available on the Queensland Government website at www.qld.gov.au, using the publication number as a search term.

You may have other legal rights or obligations and should seek your own legal advice.

D. Penalty

Failure to comply with a notice to conduct or commission an environmental evaluation is an offence.

Notice to conduct or commission an environmental evaluation

1. The maximum penalty for an individual is 300 penalty units.
2. The maximum penalty for a corporation is 1500 penalty units.

Should you have any queries in relation to this notice, please contact Natalie Wheeler, Principal Environmental Officer on (07) 4971 6550 or email cwes_gladstone@des.qld.gov.au.



Signature

16 October 2023

Date

Dr Jason Plumb

Compliance Delivery Manager (Acting)

Delegate of the Chief Executive

Department of Environment and Science

Environmental Protection Act 1994



ERM HAS OVER 160 OFFICES ACROSS THE FOLLOWING
COUNTRIES AND TERRITORIES WORLDWIDE

Argentina	The Netherlands
Australia	New Zealand
Belgium	Peru
Brazil	Poland
Canada	Portugal
China	Romania
Colombia	Senegal
France	Singapore
Germany	South Africa
Ghana	South Korea
Guyana	Spain
Hong Kong	Switzerland
India	Taiwan
Indonesia	Tanzania
Ireland	Thailand
Italy	UAE
Japan	UK
Kazakhstan	US
Kenya	Vietnam
Malaysia	
Mexico	
Mozambique	

ERM's Brisbane Office

Level 9, 260 Queen St
Brisbane, QLD, 4000
+61 7 3839 8393
F: +61 7 3839 8381

www.erm.com